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BEFORE THE ARIZONA CORPORATION COMMISSION

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COMMISSIONERS
MIKE GLEASON, Chairman
WILLIAM A. MUNDELL
JEFF HATCH-MILLER
KRISTIN K. MAYES
GARY PIERCE

IN THE MATTER OF THE APPLICATION OF NORTHERN ARIZONA ENERGY, LLC, IN CONFORMANCE WITH THE REQUIREMENTS OF ARIZONA REVISED STATUTES 40-360.03 AND 40-360.06, FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AUTHORIZING CONSTRUCTION OF A 175 MW NATURAL GAS-FIRED, SIMPLE CYCLE GENERATING FACILITY AND ASSOCIATED TRANSMISSION LINE INTERCONNECTING THE GENERATING FACILITY TO THE ADJACENT WESTERN AREA POWER ADMINISTRATION GRIFFITH SWITCHYARD, ALL LOCATED IN MOHAVE COUNTY APPROXIMATELY 9 MILES SOUTHWEST OF KINGMAN, ARIZONA.

DOCKET NO. L-00000FF-07-0134-00133

NOTICE OF FILING APPLICANT'S SUPPLEMENTAL INFORMATION

Applicant, Northern Arizona Energy, LLC, hereby provides notice that it is filing herewith Supplemental Information to Application for a Certificate of Environmental Compatibility for the Northern Arizona Energy Project.

RESPECTFULLY SUBMITTED this 22nd day of June, 2007.

MOYES STOREY, LTD.

Jay I. Moyes

Jay I. Moyes
1850 N. Central Avenue, Suite 1100
Phoenix, Arizona 85004
(602) 604-2141

Arizona Corporation Commission
DOCKETED
JUN 22 2007
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Original and Twenty-Eight (28) copies
of the foregoing filed this 22nd day of
June 2007 with:

Docket Control
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

Copy of the foregoing hand-delivered
this 22nd day of June 2007 to:

Laurie Woodall, Chairman
Arizona Power Plant & Transmission
Line Siting Committee
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Jack Ehrhardt
P.O. Box 179
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BEFORE THE ARIZONA CORPORATION COMMISSION

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IN THE MATTER OF THE APPLICATION OF NORTHERN ARIZONA ENERGY, LLC, IN CONFORMANCE WITH THE REQUIREMENTS OF ARIZONA REVISED STATUTES 40-360.03 AND 40-360.06, FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AUTHORIZING CONSTRUCTION OF A 175 MW NATURAL GAS-FIRED, SIMPLE CYCLE GENERATING FACILITY AND ASSOCIATED TRANSMISSION LINE INTERCONNECTING THE GENERATING FACILITY TO THE ADJACENT WESTERN AREA POWER ADMINISTRATION GRIFFITH SWITCHYARD, ALL LOCATED IN MOHAVE COUNTY APPROXIMATELY 9 MILES SOUTHWEST OF KINGMAN, ARIZONA.	DOCKET NO. L-00000FF-07-0134-00133 **NOTICE OF FILING APPLICANT'S SUPPLEMENTAL INFORMATION**

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[signature]

Supplemental Information to Application for a Certificate of Environmental Compatibility

Northern Arizona Energy Project

Prepared for:

State of Arizona Power Plant and Transmission Line Siting Committee

Submitted by:

Northern Arizona Energy, LLC

Date: ____________

Case No. L-OOOOOFF-07-0134-00133

BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

In the matter of the Application of Northern Arizona Energy, LLC, in conformance with the requirements of Arizona Revised Statutes 40-360.03 and 40-360.06, for a Certificate of Environmental Compatibility authorizing construction of a 175 MW natural gas-fired, simple cycle generating facility and associated transmission line interconnecting the generating facility to the adjacent Western Area Power Administration Griffith Switchyard, all located in Mohave County approximately 9 miles southwest of Kingman, Arizona.

Case No. L-OOOOOFF-07-0134-00133

SUPPLEMENTAL INFORMATION TO

APPLICATION FOR

CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY

INDEX

A

Northern Arizona Energy Project
Case No. 00133

Supplemental Information Package

Applicant's Responses to Questions and Requests from the Arizona Power Plant and Transmission Line Siting Committee and/or the Arizona Corporation Commission Staff at the May 1-2, 2007 Public Hearing in Kingman, Arizona

1. Post the Applicant's Power Point slide presentation on the Applicant Project Website at www.northernarizonaenergy.com

   Response 1
   Completed

2. Post future hearing notices and key public process dates for both the CEC process and the NEPA process on the Applicant Project Website at www.northernarizonaenergy.com

   Response 2
   On-Going

3. Resubmit information related to the transmission line contained in Section K of the Application in a format addressing sequentially the series of questions in R14-3-219.4.b.

   Response 3

   Supplement Attachment 1 provides supplemental pages to insert at the beginning of Section 4 of the Application, "Description of the Project", providing in concise text format the basic information responsive to R 14-3-219 (4) with respect to (a) the proposed generating facility and (b) the proposed interconnecting transmission line, respectively, in the same sequence as provided in R14-3-219. Additionally, Applicant has provided, in this Response 3 and the following Response 4, cross reference tables identifying that information as and where it appears in the original Application.

Supplement Table 3.0

Statute Section (R14-3-219.4b.)	Information Requested	Information Provided in Application	Application Reference (page and Figures)
i (a)	Nominal voltage for with the line as designed;	230 kV	K-1, para. 1

i (b)	Description of the <u>proposed structures</u> and <u>switchyards</u> or substations associated therewith;	The **Griffith Switchyard** consists of twelve 230kV circuit breakers arranged in a breaker-and-a-half configuration. The **interconnection of the two new transmission lines associated with the Project requires the addition of a new breaker-and-a-half bay consisting of three new 230kV circuit breakers with associated isolation switches.** This expansion of the Griffith Switchyard will require additional property (approximately one (1) acre) to be deeded to Western ownership. The Project's electric transmission lines, constructed on the Project Property, will be constructed with double circuits on tubular steel poles. The poles will be 100 to 120 feet tall with three arms on each side, approximately 17 feet apart to support the conductors and a smaller arm on each side above the conductor arms to support the overhead ground wires used for lightning protection. **Figure K-1** shows a schematic of the proposed transmission structure.	K-1, para 2, 3
i (c)	Purpose for constructing said transmission line	The **interconnection of the Project** requires two new very short 230kV transmission lines that will be constructed within the Project Property and will connect the high-side of the GSU transformers **to the nearly-adjacent expanded Griffith Switchyard**.	K-1, para. 1
ii (a)	Description of geographical points between which the transmission line will run,	The interconnection of the Project requires two new very short 230kV transmission lines that will be constructed within the Project Property and will connect the **high-side of the GSU transformers to the nearly-adjacent expanded Griffith Switchyard.**	K-1, para. 1 Also see Figure 2 "Power Plant and Associated Facilities
ii (b)	the straight line distance between such points and the length of the transmission line for each alternate route for which application is made	The line between the Project GSU transformers and the Griffith Switchyard will be approximately 2657 feet long and will require approximately 12 structures. (No alternate routes are proposed.)	K-1, para. 4
iii (a)	Nominal width of right-of-way required;	Nominal width of approximately 150 feet, all located within Property owned by Applicant or affiliate of Applicant; <u>no</u> third party right-of-way required.	
iii (b)	Nominal length of spans;	The poles will be 100 to 120 feet tall, with three arms on each side, vertically separated 17-20	K-1, para. 3

		feet, to support the conductors, and a smaller arm on each side above the conductor arms to support the overhead ground wires used for lightning protection	
iii (c)	Maximum height of supporting structures;	The poles will be 100 to **120 feet tall** with three arms on each side	K-1, para. 3
iii (d)	Minimum height of conductor above ground	56"6" at the lowest arm of the poles.	Figure K-1 Proposed Transmission Structure
iv	To the extent available, estimated costs of proposed transmission line and route	Cost estimates for the specified transmission lines were **not available at the time the Application was filed.**	
v	Description of proposed route and switchyard locations	Text of **Exhibit K**.	Figure 2 "Power Plant and Associated Facilities" for proposed route
vi	Ownership percentages of land traversed by the entire route (federal, state, Indian, private)	100% private lands owned by Applicant or its affiliate. Page 13 Section 4.5.2.1 "The entirety of the electric interconnection with the Western system occurs within the Project Property and or the Original Griffith Property"	Page 13 Section 4.5.2.1, Figure 2 "Power Plant and Associated Facilities"

4. Provide a cross reference of the information items required by R14-3-219 (for power plants) with the relevant section(s) in the Application containing such information.

Response 4
See explanation to Response 3, above, and Supplement Table 4.0 below

Supplement Table 4.0

Statute Section (R14-3-219.4a.)	Information Requested	Information Provided in Application	Application Reference (Page and Figures)
i	Type of generating facility	….**175 MW natural gas-fired, simple cycle** generating facility and associated transmission line interconnecting the…. The Project is comprised of four (4), General Electric (GE) LM6000 PC SPRINT NxGen combustion turbine generators (CTG) with inlet air chillers. The Project will be designed to produce 175 MW of net electrical output with a heat rate of	Caption of CEC Application Executive Summary

		9,975 Btu/kWh (HHV) based upon the design condition ambient temperature of 90 degrees Fahrenheit (°F). The CTGs are capable of rapid start-up, allowing the Project to respond to fluctuations in electric demand within ten (10) minutes. The Northern Arizona Energy Project (Project) is a natural gas fired, simple cycle power plant that will supply power to load-serving entities in Arizona and surrounding regions for the purpose of serving their customers during periods of peak electricity demand. The Project is comprised of four (4), General Electric (GE) LM6000 PC SPRINT NxGen combustion turbine generators (CTG) with inlet air chiller modules. The Project will be designed to produce 175 MW of net electrical output with a heat rate of 9975 Btu/kWh (HHV) based upon the design condition ambient temperature of 90 degrees Fahrenheit (°F). The CTGs are capable of rapid start-up, allowing the Project to respond to fluctuations in electric demand within ten (10) minutes.	 Section 4, Page 2
ii	Number and size of proposed units	The **Project is comprised of four (4),** General Electric (GE) LM6000 PC SPRINT NxGen combustion turbine **generators** (CTG) with inlet air chiller modules. The **Project will be designed to produce 175 MW of net electrical output**	Section 4, Page 2
iii	The source and type of fuel to be utilized, including proximate analysis of fossil fuels	High-pressure **natural gas** will be supplied to the Project from any combination of the El Paso Natural Gas Company (El Paso), Questar Corporation (Questar), and Transwestern Pipeline Company (Transwestern) natural gas interstate pipelines to the **UNS local gas distribution system located adjacent to the Project Site.** Table 4-2 Project Natural Gas Analysis	Section 4.4, page 11 Page 21
iv	Amount of fuel to be used daily, monthly, and yearly.	The Project will utilize an average of approximately 1,750 Million British Thermal Units (MMBtu) (HHV) of gas per hour; 28,000 MMBtu per 16-hour day, and 42,000 MMBtu per 24-hour day. Assuming a conservatively high 5,000 annual operating hours for each unit, the Project will utilize 8,750,000 MMBtu of gas per year. *(Note: monthly fuel usage is based on economic dispatch; at maximum monthly hours of 744 for*	Section 4.4.1, page 11

		31 day month, fuel usage is 1,302,000 MMBtu)	
v (a)	Type of cooling to be utilized and....	*4.2.5.2 CTG Cooling* The generators are air-cooled. The lube oil for the CTGs is cooled by a closed loop water-glycol system with water-to-air (fin fan) coolers. *4.2.5.3 Inlet Air Chiller* The four (4) CTG units are served by one shared inlet air chiller system providing 6500 nominal refrigeration tons of chilled water. The chiller system is comprised of two chillers arranged in a series configuration. Cooling for the chiller is provided by a cooling module located above the chiller skid. Refrigerant utilized for the chiller will be R-123	Page 7, 8
v (b)	source of water to be utilized	4.6.2 Source of Water The existing I-40 Industrial Corridor Water System owned by Mohave County is capable of supplying a minimum of 5,000 gpm of water from the **Sacramento Valley aquifer**. The system consists of six (6) groundwater wells approximately 1200-1400 feet in depth, a water pipeline collection and distribution system and a 1.3 million gallon storage tank located north of the Project Site. The Griffith Owner contractual volume (peak flow capacity) under a Water Interconnection and Supply Agreement with Mohave County is 4500 gpm, of which 450 gpm will be allocated to the Project. The expected water use rate for the Project is 345 gpm and the water demand under extreme temperature conditions (113°F) is 380 gpm, thus allowing for a 30 percent water supply capacity margin over expected conditions and nearly a 20 percent margin during extreme temperature conditions. The groundwater allocation from the Sacramento Valley aquifer and the capacity contracted in combination by Griffith Owner and Applicant remain unchanged as a result of the Project.	Page 14
vi	Proposed height of stacks and number of stacks	Each of the **four exhaust stacks** will **be 85 feet in height** and 10 feet in diameter	Page 2

vii	Dates for scheduled startup and firm operation of each unit and date construction must commence in order to meet schedules	4.9.3 Engineering, Procurement and Construction Schedule The field construction schedule from site mobilization to commercial operation for a four (4) unit simple cycle project is typically nine (9) to twelve (12) months. Depending on equipment fabrication and delivery durations, detailed engineering and procurement activities are initiated up to twelve (12) months in advance of site mobilization to assure that equipment deliveries occur to support the construction schedule. Market conditions can impact both the equipment lead times and the construction labor availability thus extending EPC schedules. The key Project schedule milestones are presented in **Table 4-4, Anticipated Project Schedule**. 4.9.3.1 Potential Modified *Construction Schedule* Depending on market conditions, the Project may be constructed in a two-phased construction sequence with two (2) units being advanced to construction immediately upon the receipt of environmental approvals and completion of power purchase agreements and the second two (2) units constructed within five (5) years of receipt of environmental approvals.	Page 17-18
viii	To the extent available, the estimated costs of the proposed facilities and site, stated separately	4.9.1 Project Cost The cost of the Project is estimated to be in the range of $140 to $160 million. The cost includes the CTGs, gas compressors, transformers, chiller, gas, water and electric transmission interconnection facilities and all ancillary balance of plant equipment as well as all civil works, construction labor, construction materials, and engineering. In addition, the Project cost includes the cost estimates for gas and electric interconnections performed by the interconnecting utilities and Applicant's costs for development, insurance and financing. *The cost of acquiring site from current owner, Applicant's affiliate, is not available yet..*	Page 17

ix	Legal description of proposed site	4.1.2 Legal Description The Project is located on a parcel of undeveloped land comprising essentially the **North seven hundred (700) feet of the North One-half of the Southwest Quarter of Section 6, Township 19 North, Range 17 West, Gila & Salt River Base & Meridian, Mohave County, Arizona, containing approximately forty (40) acres.**	Page 5

5. Provide information related to those Unisource subsidiaries operating in Mohave County and their relationship to Tucson Electric Power.

<u>Response 5</u>

Unisource and the Applicant are not affiliated. Unisource represents only a potential customer for the capacity and energy of the Northern Arizona Energy Project. Therefore, Applicant cannot provide any direct testimony as to organization of the Unisource Energy Corporation operating subsidiaries. Publicly available information is provided below.

The Unisource Energy Corporate website is: www.uns.com

The following information on the operating companies was presented on the website:

"UniSource Energy's primary subsidiaries include ***Tucson Electric Power*** (TEP), which serves more than 385,000 customers in southern Arizona; and ***UniSource Energy Services*** (UES), a utility that delivers natural gas and electric service to more than 224,000 customers across Arizona.

TEP, the second largest investor-owned electric utility in Arizona, is the principal operating subsidiary of UniSource Energy. Over 80 percent of TEP's energy needs are supplied by low-cost, coal-fired generating plants. TEP's retail customer base, which includes the Tucson metropolitan area, grows at over 2 percent annually; more than double the national average.

UES' operating companies, ***UNS Gas*** and ***UNS Electric***, are distribution companies that provide gas and electric service to over 30 communities in some of the fastest growing areas in Arizona, with customer bases expanding by approximately 4 percent a year. Both utilities have incorporated these dynamic growth rates into their planning to ensure that their systems are ready to serve customers' needs both today and tomorrow. " (***emphasis added***)

<u>The following is an excerpt from the Unisource Energy Corporation 2006 Annual Report.</u>

Overview: UniSource Energy Corporation

UniSource Energy's common stock is traded on the New York Stock Exchange under the ticker symbol UNS. The corporation's major subsidiaries and affiliates include:

Tucson Electric Power Company (TEP)
Founded in 1892, TEP is the principal subsidiary of UniSource Energy. TEP is an electric utility with more than 2,000 megawatts of generating capacity and 20,000-plus miles of power lines to help serve customers in a southern Arizona service territory spanning 1,155 square miles.

UniSource Energy Services (UES)
UES was established in 2003 to operate natural gas and electric systems acquired that year from Citizens Communications Company. UES provides service in northern and southern Arizona.

Millennium Energy Holdings (Millennium)
Millennium, established in 1997, is the parent company of UniSource Energy's unregulated energy businesses.

6. Provide a property tax revenue forecast to Mohave County tax recipients. Provide other local tax benefits forecasted for the Project, if constructed and operated.

Response 6
Based on various assumptions including a personal property tax base of approximately \$100 MM, and a tax in-service date of 7/1/09, NAE estimates that annual property taxes payable by the project are as shown on Attachment 2. Attachment 2 also presents the allocation of such payments among the various taxing authorities, based on the allocation factors in effect for 2006. In addition to property tax revenue, Mohave County will benefit from a portion of the Transaction Privilege Tax (i.e. sales tax) during construction.
See **Attachment 2, Property Tax Revenue Estimated Forecast: Mohave County**

7. List the viable vendors that would supply demineralizer trailer service to NAEP; and provide location of regeneration sites and amount of water used in the regeneration process

Response 7
See Supplement Table 7.0 below for candidate vendors.

Supplement Table 7.0

Vendor Name	Authorized Facility for Trailer Regeneration (City, State)	Water Consumption for Regeneration (gallons per trailer)
Ecolochem	Phoenix, AZ	12,600*
PureTech	Oxnard, CA	12,600*
Siemens Water Technologies	Los Angeles, CA	12,600*

* One trailer (containing 360 cubic feet of resin) is depleted in approximately 18 days of maximum NAEP water use.

The demineralizer vendor will be selected prior to Commercial Operation of the NAEP. (Applicant does not guarantee that the selected vendor will be one of the currently identified candidates.)

8. Describe any Notice of Violations (NOV) from the Arizona Department of Environmental Quality under the Griffith Energy Title V Air Quality Permit No. 1000940 since the inception of the project. Provide a witness that can discuss any such violation.

Response 8

An NOV was issued to Griffith in 2003 due to a fiberglass water return line breaking at the main cooling water tower. The water pipe break allowed water to leave the Griffith Energy site. The break was repaired to compliance standards.

9. Provide the air quality permit threshold that would trigger requirement of an amendment to the air permit.

Response 9

The air quality permit issued by ADEQ will establish tons per year limits for the entire Project (all four combustion turbine generators). The Project will operate within the annual tons per year emission limits. Any combination of full load and part load operating hours during various ambient conditions, plus startups and shutdowns, could contribute to this annual emissions profile for the Project. For simplicity, we have provided one scenario in the Class I Air Permit Application (Table 3.1 in Application).

Supplement Table 9.0

	NOx	CO	SO_2	VOC	PM_{10}
Expected Permit Limits (tons/year) [1]	39.0	90.0	36.0	36.0	14.5
Regulatory Annual Emission Limits for NAEP (tons/year) [2]	**40.0**	**100.0**	**40.0**	**40.0**	**15.0**
Annual Emission Limits for a Separate Minor Source Facility (tons/year) [3]	250.0	250.0	250.0	250.0	250.0

[1] Based on 10,600 hrs total operation (aggregate of four units) including startup/shutdown
[2] Annual limits established by regulations for any minor modification to a major source
[3] Annual emission limits if NAEP were deemed an individual minor source project (*i.e.*, if NAEP were separate from any existing major source unit, *e.g.*, Griffith.)

10. Reflect any easements from Griffith required for the transmission line.

Response 10

In support of the electric interconnection, NAEP will obtain from Griffith Energy, LLC, a right of way or easement, approximately 150 feet in width and 530 feet in length from the Southeastern corner of the NAEP Project Property to the Eastern edge of the Griffith Switchyard (as modified), all within the existing Griffith Energy Project property.

11. Provide the distance from the Project Site to the City of Kingman boundary.

Response 11
9 miles (also provided in testimony on May 2, 2007)

12. Provide any public complaints for noise or other general nuisances complaints against the Griffith Energy Project since inception of operation in 2002.

Response 12
None

13. Discuss liquefied natural gas (LNG) as a potential secondary source of gas supply for the Project.

Response 13
TransCanada, through its subsidiary North Baja, LLC, is advancing an expansion of the North Baja pipeline from the Mexican border (near Yuma, Arizona,) to an interconnection point with the El Paso Natural Gas Pipeline near Ehrenberg, Arizona, as well as an interconnection point with the Southern California Gas Company pipeline system in Blythe, California. This expansion will not only increase pipeline capacity between Mexico and the US, but the expansion project will result in a reversal of predominate flows from the existing North-South (gas exports to Mexico) to South-North (imports from Mexico) to support the import of LNG to the US market. The expected completion date of the Phase 1 expansion of the North Baja pipeline is the fourth quarter of 2008. This will introduce a new gas supply alternative for the Project through its interconnection with the El Paso Natural Gas Company interstate pipeline.

14. Provide the startup times for a combined cycle generating facility.

Response 14

Supplement Table 14.0 has been provided from the operating experience of the Griffith Energy Project, which is representative of the combined cycle class of generation facilities. This Response is presented to correct the impromptu testimony of Mr. Joe Otahal responsive to Committee questions during the May 2nd hearing.

Supplement Table 14.0

Type of Start	"Start" Defined by Off-line Time	Start Duration (hours)
Cold-Cold	Unit has been off-line for more than 5 days	~ 4 hours
Cold	Unit has been off-line for 3 to 5 days	~ 4 hours
Warm	Unit has been off-line for 48 to 72 hours	~ 2 hours
Hot	Unit has been off-line for less than 48 hours	~ 1 hour

15. Post the Power Point Slide presentation of Mr. David Swanson on the Applicant Project website at www.northernarizonaenergy.com.

Response 15
Completed

16. Post the Application for a Certificate of Environmental Compatibility on the Applicant Project website at www.northernarizonaenergy.com.

Response 16
Completed

17. Provide the source documents for the testimony of Mr. Joe Gorberg.

Response 17
See **Supplement Attachment 3, Source Documents for Market Need Testimony**

18. Provide the capacity factor for the Griffith Energy Project over the prior twelve months.

Response 18
During May 2006 through July 2006, the Griffith Energy Project was unavailable due to mechanical issues related to the steam turbine.

The monthly Capacity Factors for August 2006 through April 2007 were as follows:

Month	Capacity Factor
Aug 06	73.7%
Sept 06	67.7%
Oct 06	65.2%
Nov 06	45.1%
Dec 06	39.3%
Jan 07	27.2%
Feb 07	13.5%
Mar 07	0%
April 07	0%

19. Discuss the noise level at the western property boundary adjacent to parcels that have been platted for residential development.

Response 19

The noise levels at the adjacent parcels that have been platted for residential development is predicted at 41 L_{eq} and 48 L_{dn}. These parcels were platted for subdivision on January 4, 1960 and no development activity has been conducted in the ensuing 47 years.

20. Provide the historical filings with respect to the Griffith CEC Conditions, namely CEC Condition Numbers 2, 3, 4 and 5.

Response 20
See **Supplement Attachment 4, Griffith Energy CEC Compliance Filings**

21. Submit any prior studies upon which Greystone/Arcadis relied in their environmental studies with respect to the Project.

Response 21
When the CEC Application was prepared, it was assumed that the source of water for the Northern Arizona Energy Project (NAEP) would be a portion of the water that had been already allocated and evaluated for the Griffith Energy Project. Therefore, with respect to the water analysis for the NAEP, the CEC application relied on the conclusions of previous hydrology studies conducted for the Griffith Energy Project indicating that the planned use of water from the Sacramento Valley aquifer would not cause significant negative impacts to the aquifer or existing water users. These prior studies have been incorporated by reference Southwest Ground-water Consultants, Inc Report included with this Supplemental Information Package (separate binding). No other prior studies were relied upon in lieu of conducting the necessary new studies to address the environmental impacts as discussed in the Application; however, the Environmental Assessment published for the Griffith Energy Project was reviewed along with other such environmental analyses materials as reference materials for the studies conducted by Greystond/Arcadis for the NAEP.

22. Discuss the impact to the performance of the Project (output/fuel efficiency) if the inlet air chiller module was replaced by an air heat exchanger mechanical chiller.

Response 22

The substitution of a dry cooled chiller has the net effect of reducing plant generating capability and decreasing efficiency (increasing Heat Rate). This effect is exaggerated during high ambient temperature conditions, and these are typically the conditions during peak electricity demand periods when NAEP will be called upon to meet system needs. On a high temperature day, the generation output will decrease by 5.8 MW and the heat rate (efficiency loss) will increase 4.2%.

23. Discuss the fire loop expansion and why a coincident fire event is acceptable.

Response 23
The National Fire Protection Association (NFPA) provides guidance on the design and operation of fire protection systems. The NFPA, stipulates standards for fire water storage,

pump and delivery systems requirements. The extension of the existing Griffith fire system to serve the Project complies with the National Fire Protection Association (NFPA) standards.

24. Compare the annual emissions profile of Griffith Energy with the NAEP emissions profile.

Response 24

Supplement Table 24

Comparison of Key Air Emission Rates[a]					
	Concentration Limits (ppm)[b]				
	VOC	CO	NOx	SOx	PM_{10}
NAEP[c]	5	6	5	2.8	N/A
Griffith Energy[d]	--	10-20	3	--	N/A
Sundance[e]	--	7.5 - 15	5	--	N/A
Black Mountain[f]	--	--	75	--	N/A
	Maximum Annual Mass Emission Rates(tons per year)				
	VOC	CO	NOx	SOx	PM_{10}
NAEP[c]	16	36	40	32	15
Griffith Energy[d]	310	872	266	50	280
Sundance[e]	189	356	459	41	315
Black Mountain[f]	7	245	246	12	26

Notes:

a. NAEP (175 MW), Sundance (540 MW) and Black Mountain (96 MW) are all simple cycle plants using LM6000 combustion turbines. Griffith Energy is a 650 MW combined cycle plant using 7FA combustion turbines.

b. Concentrations are expressed as parts per million, by volume, dry basis, corrected to 15% oxygen.

c. NAEP data from April 2, 2007 application to ADEQ.

d. Griffith data from August 31, 1999 ADEQ permit. CO limit varies depending on duct firing.

e. Sundance Energy data from July 25, 2001 ADEQ permit. CO concentration limit varies with ambient temperature.

f. Black Mountain data from April 16, 2007 draft permit proposed for issuance by ADEQ.

25. How was the Black Mountain project proposed by Unisource incorporated into the impacts modeling for NAEP?

Response 25

Cumulative modeling only included Griffith Energy and NAEP as described in the ADEQ-approved Air Dispersion Modeling Protocol for this minor modification to a major source permit application. No PSD modeling was conducted for NAEP given the annual emission limits established.

1

This attachment should be deemed inserted into the Application at Page 2a immediately after the heading on Section 4, as a supplement to, not a replacement for, the balance of Section 4 in the Application.

Supplement Attachment 1

Information called for by R-14-3-219 (4):

(a) **with respect to an electric generating plant**:

i. **Type of generating facility**:

Natural gas-fired, simple cycle combustion turbines

ii. **Number and size of proposed units**:

Four; nominal 45 MW each

iii. **The source and type of fuel to be utilized**:

Natural gas, from local utility, UNS Gas, distribution line adjacent to Project site; accessing supplies from El Paso, Transwestern and Questar pipelines and associated regional gas fields and markets.

iv. **Amount of fuel to be utilized daily, monthly and yearly**:

Estimated fuel use, depending upon dispatch hours:

Daily (16 hour dispatch): 28,000 MMBtu
Daily (24 hour dispatch): 42,000 MMBtu
Monthly (if 744 hours dispatch): 1,302,000 MMBtu
Yearly (if 5,000 hours dispatch): 8,750,000 MMBtu

v. **Type of cooling to be utilized and source of any water to be utilized**:

The generators are air cooled. Inlet air to combustion turbines is chilled by two chillers with evaporative cooling tower modules, which will require makeup water. The source of the water is groundwater from the Sacramento Valley aquifer.

vi. **Proposed height of stacks and number of stacks, if any**:

Four stacks, 85 feet in height

vii. **Dates for scheduled start-up and firm operation of each unit and date construction must commence in order to meet schedules**:

Schedule contingent upon securing power supply agreements with purchasing utilities, followed by estimated 9-12 month detailed engineering/procurement period, followed by 9-12 month construction and start-up schedule.

viii. **To the extent available, the estimated costs of the proposed facilities and site, stated separately**:

$140-160 Million for Project Facilities. Cost of acquiring site from Applicant's affiliate not known at this time.

ix. **Legal description of proposed site**:

The North 700 feet of the North ½ of the Southwest Quarter, Section 6, Township 19 North, Range 17 West, G&SRB&M, comprising approximately 40 acres.

(b) With respect to a proposed transmission line:

i. Nominal voltage for which the line is designed; description of the proposed structures and switchyards or substation associated therewith; and purpose for constructing said transmission line:

Voltage: 230 kV
Structures: Approximately 12 single-pole steel towers, 100-120 feet tall, double circuit, with three arms per side.
Substation: Expansion of adjacent existing WAPA Griffith Substation, adding a new breaker-and-a-half bay with 3 new 230kV circuit breakers and associated equipment.
Purpose: Interconnection of the Project generators with existing WAPA 230kV transmission system at existing Griffith Substation.

ii. Description of geographical points between which the transmission line will run, the straight-line distance between such points and the length of the transmission line for each alternative route for which application is made:

The straight-line distance from the location of the proposed generators to the existing Griffith Substation (both of which are located in the North ½ of the Southwest Quarter of Section 6, Township 19 North, Range 17 West) is approximately 1800 feet. The proposed route, all within the Project Property and the Griffith property boundaries, will run due East from the generators to near the Eastern edge of the Property, then due South to the East side of the Griffith Switchyard, then West into the Switchyard, a combined total distance of approximately 2657 feet for the entire line.

iii. **Nominal width of right-of-way required, nominal length of spans, maximum height of supporting structures and minimum height of conductor above ground**:

Nominal right-of-way width will be 150 feet; however, none will be required from third parties, as the entire route lies wholly within the Project Property and the Griffith property.

Nominal length of spans will vary, not to exceed approximately 250 feet.
Conductor height at the lowest arms on the tower structures will be approximately 56 feet, with typical sag between poles to no lower than 25' in compliance with National Electric Safety Code.

iv. **To the extent available, the estimated costs of proposed transmission line and route, stated separately**:

Estimated cost of transmission line is not available at this time. Cost of route (approximately 600 foot length of right-of-way easement from affiliate, Griffith Energy, LLC) not yet determined, but will be nominal.

v. **Description of proposed route and switchyard locations**:

See response to ii above, and Figure 2. (All within existing Griffith property boundary)

vi. **For each alternative route for which application is made, list the ownership percentages of land traversed by the entire route (federal, state, Indian, private, etc.)**:

100% privately owned by Griffith Energy, LLC, and within Griffith property Boundary.

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Attachment 2, Tax Revenue Forecast: Mohave County

Year	Kingman Unified School District #20	Mohave County General Fund	Mohave Community College	School District #20 Class A Bonds	Mohave County Library District	Fire District Asst Fund	Mohave County TV District	Mohave County Flood Control		TOTAL - ALL AUTHORITIES (1)
Allocation %	49.5%	23.9%	12.8%	6.3%	4.6%	1.4%	1.2%	0.3%		100.0%
Year of In Service (YOS)										
YOS + 1	396,000	191,200	102,400	50,640	36,800	11,360	9,840	2,000		**800,000**
YOS + 2	544,500	262,900	140,800	69,630	50,600	15,620	13,530	2,750		**1,100,000**
YOS + 3	693,000	334,600	179,200	88,620	64,400	19,880	17,220	3,500		**1,400,000**
YOS + 4	792,000	382,400	204,800	101,280	73,600	22,720	19,680	4,000		**1,600,000**
YOS + 5	841,500	406,300	217,600	107,610	78,200	24,140	20,910	4,250		**1,700,000**
YOS + 6	792,000	382,400	204,800	101,280	73,600	22,720	19,680	4,000		**1,600,000**
YOS + 7	792,000	382,400	204,800	101,280	73,600	22,720	19,680	4,000		**1,600,000**
YOS + 8	742,500	358,500	192,000	94,950	69,000	21,300	18,450	3,750		**1,500,000**
YOS + 9	693,000	334,600	179,200	88,620	64,400	19,880	17,220	3,500		**1,400,000**
YOS + 10	693,000	334,600	179,200	88,620	64,400	19,880	17,220	3,500		**1,400,000**
YOS + 11	643,500	310,700	166,400	82,290	59,800	18,460	15,990	3,250		**1,300,000**
YOS + 12	643,500	310,700	166,400	82,290	59,800	18,460	15,990	3,250		**1,300,000**
YOS + 13	594,000	286,800	153,600	75,960	55,200	17,040	14,760	3,000		**1,200,000**
YOS + 14	544,500	262,900	140,800	69,630	50,600	15,620	13,530	2,750		**1,100,000**
YOS + 15	495,000	239,000	128,000	63,300	46,000	14,200	12,300	2,500		**1,000,000**
YOS + 16	445,500	215,100	115,200	56,970	41,400	12,780	11,070	2,250		**900,000**
YOS + 17	445,500	215,100	115,200	56,970	41,400	12,780	11,070	2,250		**900,000**
YOS + 18	396,000	191,200	102,400	50,640	36,800	11,360	9,840	2,000		**800,000**
YOS + 19	346,500	167,300	89,600	44,310	32,200	9,940	8,610	1,750		**700,000**
YOS + 20	297,000	143,400	76,800	37,980	27,600	8,520	7,380	1,500		**600,000**
YOS + 21	247,500	119,500	64,000	31,650	23,000	7,100	6,150	1,250		**500,000**
YOS + 22	198,000	95,600	51,200	25,320	18,400	5,680	4,920	1,000		**400,000**
YOS + 23	148,500	71,700	38,400	18,990	13,800	4,260	3,690	750		**300,000**
YOS + 24	99,000	47,800	25,600	12,660	9,200	2,840	2,460	500		**200,000**
TOTAL										**25,300,000**

Notes:

(1) Based on estimated personal property tax base of $100 million

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a

Only the following portions of this document were relied upon as Source Documents for Joe Gorberg testimony at the May 1-2, 2007 hearing. Copies of the balance of this document will be furnished upon request, but were not copied to reduce the volume of paper in this supplement.

Western Electricity Coordinating Council

10-Year Coordinated Plan Summary

Planning and Operation for Electric System Reliability

June 2005

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WECC Region

Reporting Areas

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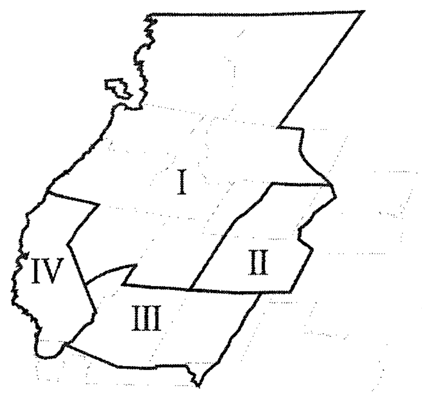
II	Rocky Mountain Power Area (RMPA)
III	Arizona-New Mexico-Southern Nevada Power Area (AZ/NM/SNV)
IV	California-Mexico Power Area (CA/MX)



Independent Power Producers/Qualified Facilities, and Marketers

AES Corporation, The	AES
Allegheny Energy Supply Company, LLC	AESC
American Wind Energy Association Company, LLC	AWEA
Automated Power Exchange, Inc.	APX
Bonneville Power Administration - PBL	BPAP
California British Columbia Transmission	CBC
Calpine Corporation	CALP
Cargill Power Markets, LLC	CRGL
CE Obsidian Energy	CEOE
Cinergy Services, Inc.	CINE
Constellation Energy Commodities Group, Inc.	CCG
Duke Energy North America, LLC	DENA
Duke Energy Trading and Marketing, LLC	DETM
Dynegy Power Corp.	DYN
Economic Insight	ECON
Edison Mission Marketing & Trading	EMMT
Energy Northwest	ENW
ENMAX Corporation	ENMX
EPCOR Merchant and Capital (US) Inc.	EMCU
EPCOR Merchant and Capital L.P.	EMC
FPL Energy LLC	FPLE
Geo-Energy Partners-1983 Ltd.	GEO
Gila Bend Power Partners, LLC	GBPP
Harquahala Generating Company, LLC	HGC
Hunt Power, L.P.	HPLP
IGI Resources, Inc.	IGI
Merryll Lynch Commodities, Inc.	MLCI
Mirant meritas, Inc.	MIR
Montana Alberta Tie Ltd.	MATL
National Energy & Gas Transmission, Inc.	NEGT
National Renewable Energy Laboratory	NREL
North American Power Group, Ltd.	NAPG
NRG Power Marketing, Inc.	NRG
Oak Creek Energy Systems, Inc.	OCES
PacifiCorp - Merchant Function	PACM
Panda Energy International, Inc.	PAND
Panda Gila River, L.P.	PGR
Peabody Energy Corporation	PBEC
Pinnacle West Energy Corporation	PWEC
Powerex	PWX
PPL EnergyPlus, LLC	PPLE
PPL Montana, LLC	PPLM
PPM Energy, Inc.	PPM
Reliant Energy, Incorporated	REI
RES-North America	RES
Saracen Merchant Energy L.P.	SME
Sempra Energy Resources	SER
Sempra Energy Trading Corp.	SETC
Shell Trading	STGP
Southwestern Power Group II, LLC	SWPG
SUEZ Energy Marketing NA, Inc.	SUEZ
Tenaska	TNSK
TransCanada Energy Ltd.	TCP
Wellhead Electric Company, Inc.	WECI
Williams Power Company, Inc.	WEMT

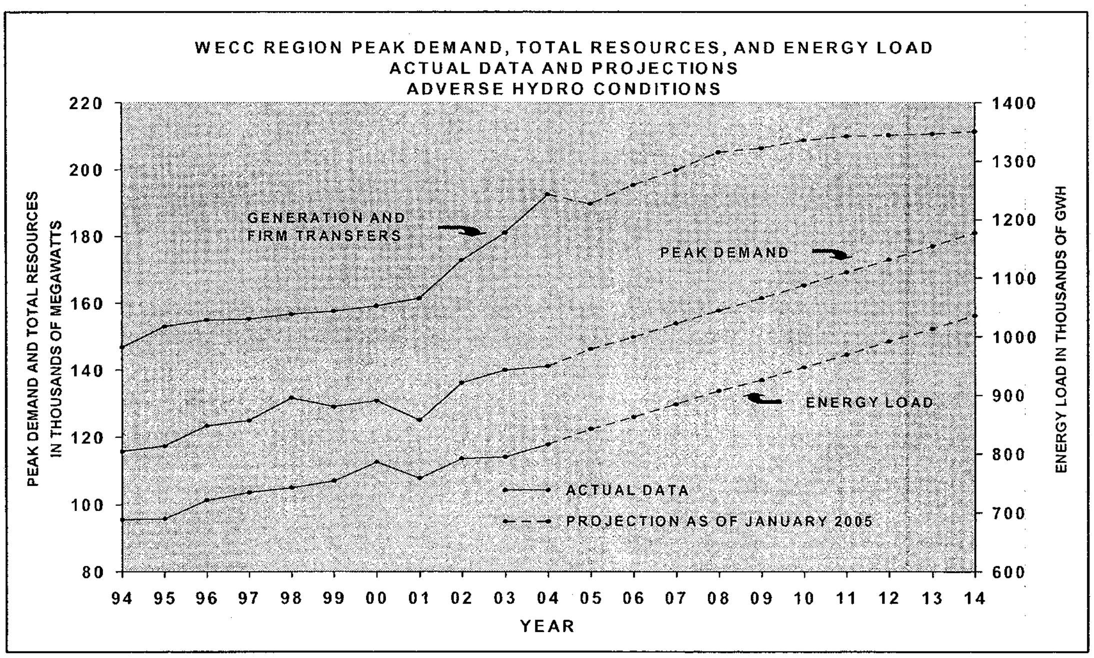


Figure 1

Table 3 - WECC Actual Loads and Resources for 2004

PEAK DEMAND – MW		JAN	FEB	MAR	APR	MAY	JUN
Loads -	Firm	120781	112684	111808	117162	120641	126691
	Interruptible & Load Mgt	1663	1691	1518	1736	1105	1874
	Total	122444	114375	113326	118898	121746	128565
	Forecast Deviation - %	-0.1	-2.7	0.5	5.3	-2.2	-2.9
Generation -	Hydro	62903	62983	62651	62801	63669	64882
	Thermal	119875	119758	119690	119715	119758	120358
	Other	6554	6557	6565	6566	6581	6572
	Total	189332	189298	188906	189082	190008	191812
Total Unavailable Generation *		16005	17845	21934	23275	18386	10098
Net Firm Transfers - MRO		19	33	55	124	194	173
	SPP **	-587	-622	-489	-622	-622	-572
	Total Net Firm Transfers	-568	-589	-434	-498	-428	-399
Net Generation & Firm Transfers		173895	172042	167406	166305	172050	182113
Margin Over Firm Loads - MW		53114	59358	55598	49143	51409	55422
Margin Over Firm Loads - Percent		44.0	52.7	49.7	41.9	42.6	43.7
ENERGY - GWH							
Total Load		69644	63334	65117	61342	66017	68856
	Forecast Deviation - %	-2.4	-2.3	-2.7	-3.4	-1.5	-0.5

PEAK DEMAND – MW		JUL	AUG	SEP	OCT	NOV	DEC	
Loads -	Firm	139169	138542	132224	112810	117845	120142	
	Interruptible & Load Mgt	1931	2314	1896	1672	1686	1687	
	Total	141100	140856	134120	114482	119531	121829	
	Forecast Deviation - %	1.1	0.5	2.9	-6.1	3.0	-1.0	
Generation -	Hydro	64741	64292	64048	63555	63108	62881	
	Thermal	120684	120648	121044	122160	123044	123117	
	Other	6595	6586	6575	6574	6557	6609	
	Total	192020	191526	191667	192289	192709	192607	
Total Unavailable Generation *		12896	10838	13974	19357	17838	19269	
Net Firm Transfers - MRO **		143	148	174	140	9	-7	
	SPP **	-622	-622	-622	-422	-572	-622	
	Total Net Firm Transfers	-479	-474	-448	-282	-563	-629	
Net Generation & Firm Transfers		179603	181162	178141	173214	175434	173967	
Margin Over Firm Loads - MW		40434	42620	45917	60404	57589	53825	
Margin Over Firm Loads - Percent		29.1	30.8	34.7	53.5	48.9	44.8	
ENERGY - GWH								TOTAL
Total Load		76178	74856	68485	65124	65566	71560	816079
	Forecast Deviation - %	2.6	-1.7	0.2	-2.1	-0.6	2.2	-1.0

* Includes Maintenance, Forced Outages, and Inoperable Capability.
** Minus (-) indicates transfer into WECC Region.

Table 4 - Projected Peak Demand Average Annual Compound Growth Rates - Percent (Adverse Hydro Conditions)

	1994 - 2004	1995 - 2005	1996 - 2006	1997 - 2007	1998 - 2008	1999 - 2009	2000 - 2010	2001 - 2011	2002 - 2012	2003 - 2013	2004 - 2014
WECC – Total	1.8	1.6	1.4	1.6	1.5	2.1	2.2	2.5	1.9	2.0	2.5
Northwest Power Pool Area	1.7	1.2	1.6	1.9	1.1	2.1	2.0	2.5	2.5	1.1	1.7
Rocky Mountain Power Area	1.9	1.7	2.0	2.0	2.2	2.7	2.0	2.3	1.7	2.0	2.6
Arizona-New Mexico-So. Nevada Power Area*	1.8	1.9	2.2	2.9	2.5	3.6	3.3	3.1	3.0	3.0	3.2
California-Mexico Power Area*	1.7	1.4	1.3	0.9	1.3	1.8	2.6	2.4	2.1	2.2	2.5

*The 1994-2004 through 1996-2006 projected peak demand growth rate percentages include the Southern Nevada reporting area data in the California-Mexico Power Area data.

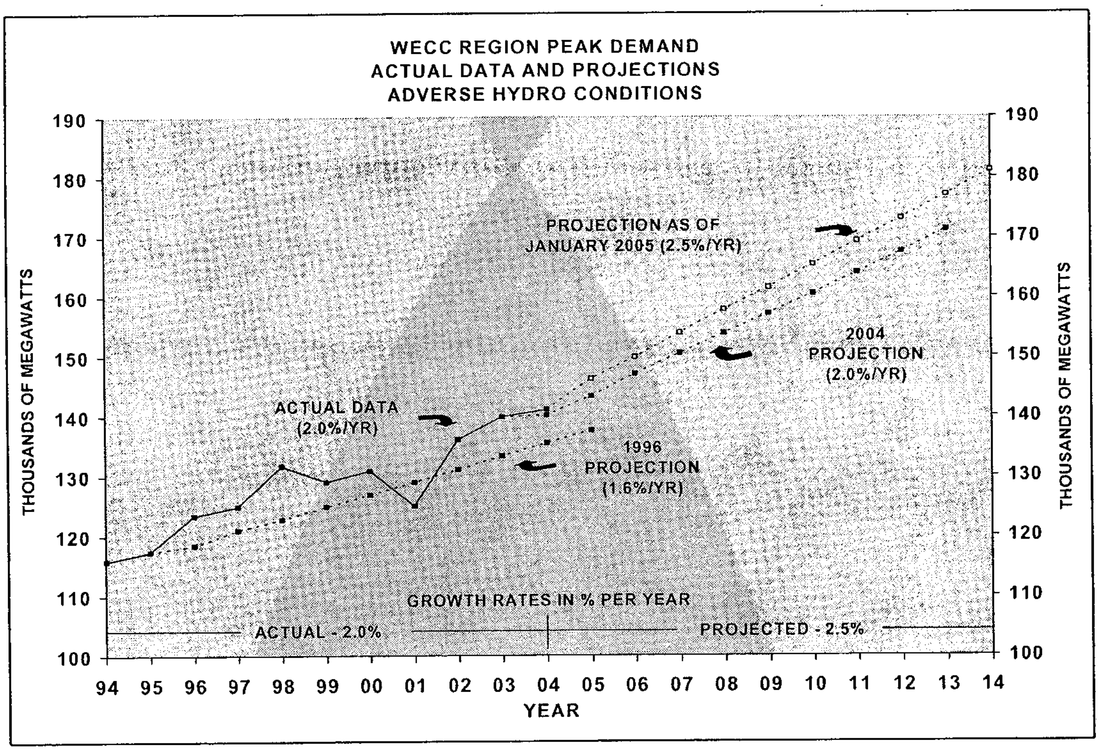


Figure 2

Table 5 – Actual Peak Demand Growth Rates – Percent (Actual Hydro Conditions)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
WECC – Total	4.4	1.3	5.1	1.3	5.4	-2.0	1.4	-4.5	8.9	2.8	0.8
Northwest Power Pool Area	2.0	8.7	-2.5	-0.4	8.4	-6.6	2.1	-8.1	-0.4	13.5	0.5
Rocky Mountain Power Area	3.4	4.5	1.9	7.1	0.6	-4.2	12.4	8.6	6.0	6.0	-0.8
Arizona-New Mexico-So. Nevada Power Area*	7.3	4.4	4.5	1.8	7.4	-2.3	8.9	7.5	3.7	5.5	0.3
California-Mexico Power Area*	5.9	-0.7	4.2	3.8	4.2	-4.1	-3.6	-5.6	8.0	1.6	5.4

*The 1994 through 1996 projected peak demand growth rate percentages include the Southern Nevada reporting area data in the California-Mexico Power Area data.

Table 6 – Actual Energy Load Growth Rates – Percent (Actual Hydro Conditions)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
WECC – Total	2.8	0.3	4.6	1.8	1.1	1.6	4.2	-3.5	4.4	0.4	2.6
Northwest Power Pool Area	1.1	0.6	5.0	-0.7	3.3	1.8	1.6	-8.6	5.7	-0.6	2.0
Rocky Mountain Power Area	3.7	3.3	1.2	7.2	2.1	-3.7	11.2	5.8	3.0	1.3	0.7
Arizona-New Mexico-So. Nevada Power Area*	7.1	1.9	8.0	4.0	-1.2	-0.4	7.7	6.6	3.9	4.2	2.0
California-Mexico Power Area*	3.4	-1.3	3.4	3.3	-0.9	3.0	5.1	-2.4	3.2	-0.2	4.1

*The 1994 through 1996 projected peak demand growth rate percentages include the Southern Nevada reporting area data in the California-Mexico Power Area data.

Table 7– WECC Estimated Peak Demands, Resources, and Reserves 2005 - 2014

	SUMMER PEAK							Adverse Hydro Conditions		
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Month	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL
Loads – Firms	143786	147411	151445	155326	159034	162893	166732	170515	174522	178548
Int. & Load Mgt	2460	2436	2450	2462	2471	2470	2471	2472	2474	2475
Total - MW	146246	149847	153895	157788	161505	165363	169203	172987	176996	181023
Growth from Previous Yr. - %	3.6	2.5	2.7	2.5	2.4	2.4	2.3	2.2	2.3	2.3
Generation ± Transfers - MW	189699	195378	199779	205166	206427	208796	209947	210256	210636	211354
Maint./Inoperable Cap. - MW	4106	4108	3566	3648	3648	3817	3649	3648	3566	3551
Reserve Capability MW	41807	43859	44768	46192	43745	42086	39566	36093	32548	29255
Percent of Firm Peak Demand	29.1	29.8	29.6	29.7	27.5	25.8	23.7	21.2	18.6	16.4

	WINTER PEAK							Adverse Hydro Conditions		
	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15
Month	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC
Loads – Firms	125496	128484	131225	134257	136988	140018	143161	146129	149166	151782
Int. & Load Mgt	1886	1861	1850	1865	1872	1871	1872	1873	1875	1876
Total - MW	127382	130345	133075	136122	138860	141889	145033	148002	151041	153658
Growth from Previous Yr. - %	3.0	2.3	2.1	2.3	2.0	2.2	2.2	2.0	2.1	1.7
Generation ± Transfers - MW	191498	196498	201356	204550	205477	208230	208879	209043	210091	210279
Maint./Inoperable Cap. - MW	13491	12305	11327	11898	11727	12285	12262	11928	11674	12024
Reserve Capability MW	52511	55709	58804	58395	56762	55927	53456	50986	49251	46473
Percent of Firm Peak Demand	41.8	43.4	44.8	43.5	41.4	39.9	37.3	34.9	33.0	30.6

Table 8 - Projected Peak Demand Growth Rates - Percent (Adverse Hydro Conditions)

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average Annual Compound Growth Rate 2004-2014
WECC - Total	Summer	3.6	2.5	2.7	2.5	2.4	2.4	2.3	2.2	2.3	2.3	2.5
	Winter	3.0	2.3	2.1	2.3	2.0	2.2	2.2	2.0	2.1	1.7	2.3
Northwest Power Pool Area	Summer	-0.8	2.1	2.7	2.2	1.8	1.9	1.9	1.8	2.0	1.9	1.7
	Winter	2.1	2.3	1.8	1.4	1.5	1.7	1.4	1.6	1.5	1.6	1.8
Rocky Mountain Power Area	Summer	4.4	2.7	2.6	2.5	2.4	2.3	2.3	2.4	2.3	2.6	2.6
	Winter	3.6	2.3	2.5	2.2	2.2	2.1	2.1	2.3	2.2	2.3	2.4
Arizona-New Mexico-So. Nevada Power Area	Summer	5.2	3.4	3.2	3.2	3.2	3.2	2.8	2.5	2.7	2.5	3.2
	Winter	2.9	2.9	2.8	3.0	3.0	2.7	2.4	2.4	2.4	2.3	3.0
California-Mexico Power Area	Summer	4.0	1.8	2.3	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.5
	Winter	2.5	2.1	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

Table 9 - Summary of Projected Energy Loads - GWh (Adverse Hydro Conditions)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
WECC – Total	841871	862828	884684	907449	925982	947228	969095	992139	1013297	1035747
Northwest Power Pool Area	354198	361653	369594	378145	383060	389443	396748	405095	411605	418745
Rocky Mountain Power Area	61858	63235	64819	66340	67720	69246	70776	72401	73917	75745
Arizona-New Mexico-So. Nevada Power Area	125270	129514	133797	138211	142078	146743	150943	154980	158919	162907
California-Mexico Power Area	300545	308426	316474	324753	333124	341796	350628	359663	368856	378350

Table 10 - Projected Energy Load Growth Rates - Percent (Adverse Hydro Conditions)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average Annual Compound Growth Rate 2004-2014
WECC – Total	3.2	2.5	2.5	2.6	2.0	2.3	2.3	2.4	2.1	2.2	2.4
Northwest Power Pool Area	2.0	2.1	2.2	2.3	1.3	1.7	1.9	2.1	1.6	1.7	1.9
Rocky Mountain Power Area	8.1	2.2	2.5	2.4	2.1	2.3	2.2	2.3	2.1	2.5	2.8
Arizona-New Mexico-So. Nevada Power Area	1.9	3.4	3.3	3.3	2.8	3.3	2.9	2.7	2.5	2.5	2.9
California-Mexico Power Area	4.1	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.7

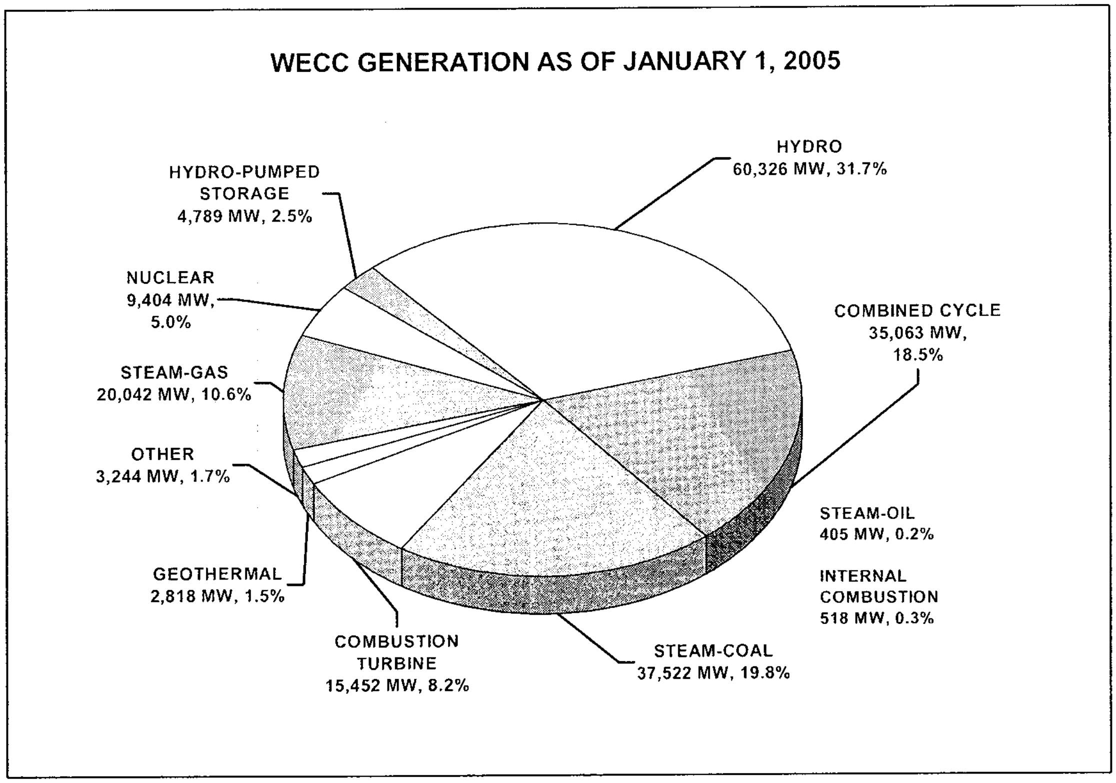


Figure 3

Table 11 - Existing Generating Capability as of January 1, 2005 (Summer Capability - MW)

Generation Type	Northwest Power Pool Area	Rocky Mountain Power Area	Arizona New Mexico So. Nevada Power Area	California Mexico Power Area	WECC Total	% of Total
Hydro - Conventional	47568	902	3795	8061	60326	31.7
Hydro - Pumped Storage	240	410	245	3894	4789	2.5
Steam - Coal	17657	6241	9863	3761	37522	19.8
Steam - Oil	0	1	128	276	405	0.2
Steam - Gas	2601	235	2249	14957	20042	10.6
Nuclear	1150	0	3804	4450	9404	5.0
Combustion Turbine	3709	1927	2979	6837	15452	8.2
Combined Cycle	7396	2598	13275	11794	35063	18.5
Geothermal	130	0	450	2238	2818	1.5
Internal Combustion	215	263	4	36	518	0.3
Other	1014	24	125	2081	3244	1.7
Total	81680	12601	36917	58385	189583	100.0
Percent of WECC Total	43.1	6.6	19.5	30.8	100.0	

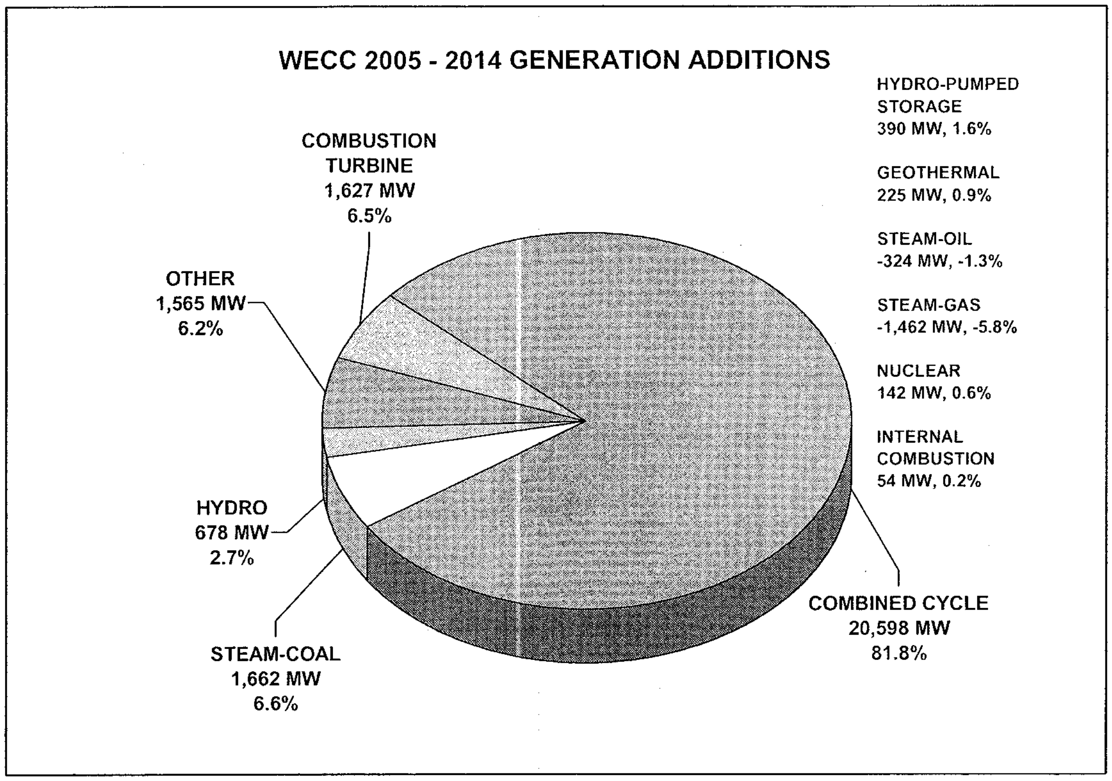


Figure 4

Table 12 - Summary of Generation Additions 2005 - 2014 (Summer Capability - MW)

Generation Type	Northwest Power Pool Area	Rocky Mountain Power Area	Arizona New Mexico So. Nevada Power Area	California Mexico Power Area	WECC Total	% of Total
Hydro - Conventional	662	0	-4	20	678	2.7
Hydro - Pumped Storage	0	0	0	390	390	1.6
Steam - Coal	2092	750	400	-1580	1662	6.6
Steam - Oil	0	0	-48	-276	-324	-1.3
Steam - Gas	0	0	-259	-1203	-1462	-5.8
Nuclear	0	0	142	0	142	0.6
Combustion Turbine	335	0	600	692	1627	6.5
Combined Cycle	6598	0	5305	8695	20598	81.8
Geothermal	30	0	195	0	225	0.9
Internal Combustion	54	0	0	0	54	0.2
Other	1506	0	14	45	1565	6.2
Total	11277	750	6345	6783	25155	100.0
Percent of WECC Total	44.8	3.0	25.2	27.0	100.0	

Table 13 - WECC Summary of Generation Additions (Summer Capability - MW)

Generation Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	10 Yr. Period	% of Total
Hydro - Conventional	61	123	4	-10	0	500	0	0	0	0	678	2.7
Hydro - Pumped Storage	0	0	0	0	0	0	0	0	0	390	390	1.6
Steam - Coal	-25	-1143	25	712	268	1250	575	0	0	0	1662	6.6
Steam - Oil	0	-48	-69	-69	0	0	0	-138	0	0	-324	-1.3
Steam - Gas	-82	-163	-600	-48	-48	0	-82	0	0	-439	-1462	-5.8
Nuclear	0	71	71	0	0	0	0	0	0	0	142	0.6
Combustion Turbine	1072	-203	282	70	114	10	44	44	264	-70	1627	6.5
Combined Cycle	4918	5354	4901	2193	613	1043	253	255	780	288	20598	81.8
Geothermal	0	30	195	0	0	0	0	0	0	0	225	0.9
Internal Combustion	54	0	0	0	0	0	0	0	0	0	54	0.2
Other	258	1016	9	275	2	1	2	2	0	0	1565	6.2
Total	6256	5037	4818	3123	949	2804	792	163	1044	169	25155	100.0

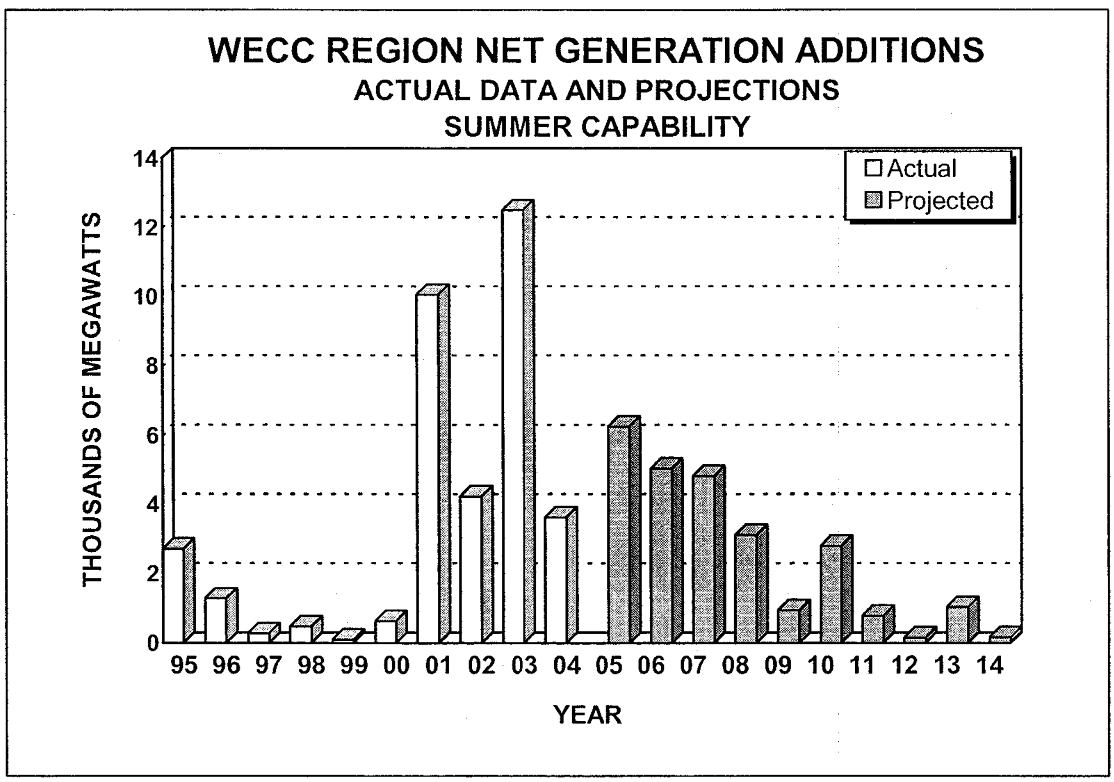


Figure 5

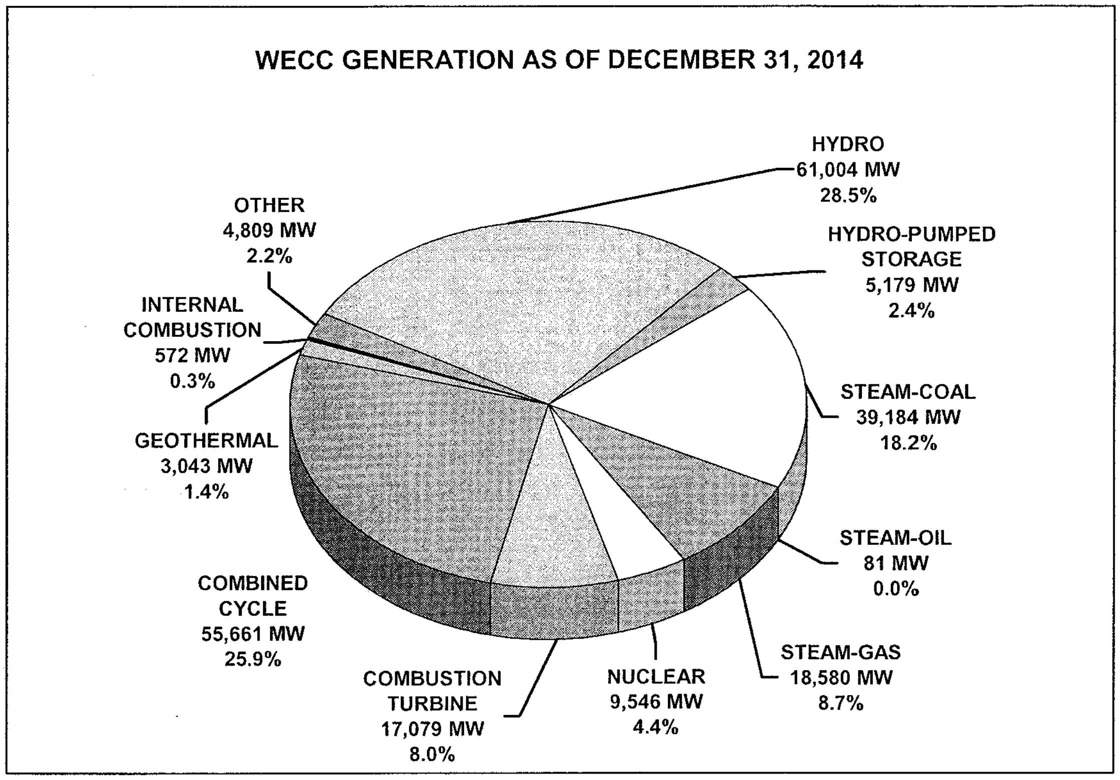
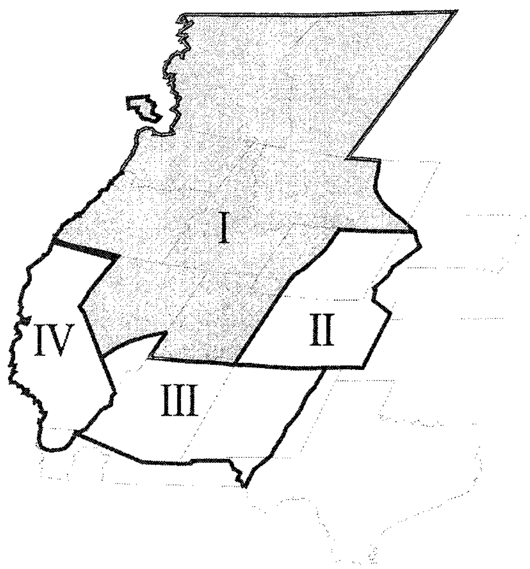


Figure 6

Table 14 - Generating Capability as of December 31, 2014 (Summer Capability - MW)

Generation Type	Northwest Power Pool Area	Rocky Mountain Power Area	Arizona New Mexico So. Nevada Power Area	California Mexico Power Area	WECC Total	% of Total
Hydro - Conventional	48230	902	3791	8081	61004	28.5
Hydro - Pumped Storage	240	410	245	4284	5179	2.4
Steam - Coal	19749	6991	10263	2181	39184	18.2
Steam - Oil	0	1	80	0	81	0.0
Steam - Gas	2601	235	1990	13754	18580	8.7
Nuclear	1150	0	3946	4450	9546	4.4
Combustion Turbine	4044	1927	3579	7529	17079	8.0
Combined Cycle	13994	2598	18580	20489	55661	25.9
Geothermal	160	0	645	2238	3043	1.4
Internal Combustion	269	263	4	36	572	0.3
Other	2520	24	139	2126	4809	2.2
Total	92957	13351	43262	65168	214738	100.0
Percent of WECC Total	43.4	6.2	20.1	30.3	100.0	

Northwest Power Pool Area (NWPP)



U.S. Systems

Avista Corp.	AVA
Bonneville Power Administration - TBL	BPAT
Chelan County PUD No. 1	CHPD
Deseret Generation & Transmission Co-operative	DGT
Douglas County PUD No. 1	DOPD
Eugene Water & Electric Board	EWEB
Grant County PUD No. 2	GCPD
Idaho Power Company	IPC
New Transmission Development Company (A TransElect Company)	NTD
NorthWestern Energy	NWMT
PacifiCorp	PAC
Pend Oreille County PUD No. 1	POPD
Portland General Electric Company	PGE
Puget Sound Energy	PSE
Seattle Department of Lighting (Seattle City Light)	SCL
Sierra Pacific Resources Transmission	SPR
Snohomish County PUD No. 1	SNPD
Tacoma Power	TPWR
U.S.B.R. Pacific Northwest Region	USPN
U.S.B.R. Upper Colorado Region	USUC
U.S. Army Corps of Engineers (North Pacific Division)	USCE
Utah Associated Municipal Power Systems	UAMP
Utah Municipal Power Agency	UMPA
Western Area Power Administration - Billings Area	WAUW

Canadian Systems

Alberta Electric System Operator	AESO
AltaLink L.P	ALTA
ATCO Electric Ltd.	ATCO
British Columbia Hydro and Power Authority	BCHA
British Columbia Transmission Corporation	BCTC
Fortis BC	FBC
Sea Breeze Pacific Regional Transmission Systems, Inc.	SBP
TransAlta Utilities Corporation	TAUC

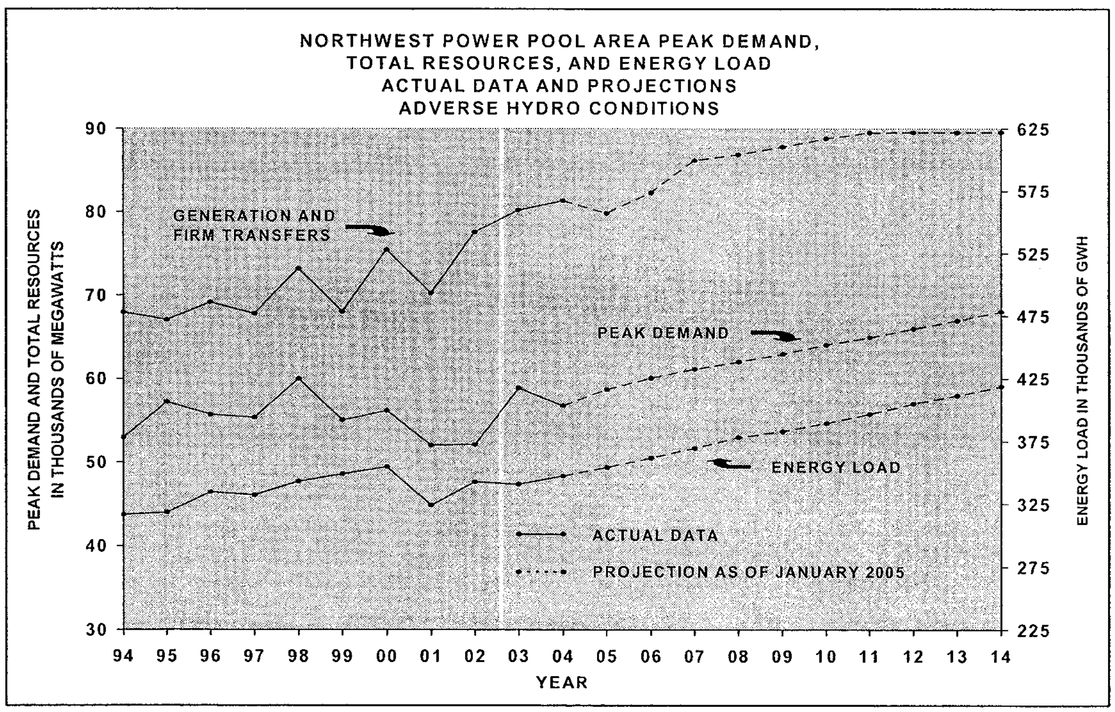


Figure 7

Table 15 - Northwest Power Pool Area Actual Loads and Resources for 2004

PEAK DEMAND – MW		JAN	FEB	MAR	APR	MAY	JUN
Loads -	Firm	58727	52023	48770	45396	43481	48324
	Interruptible & Load Mgt	160	160	160	160	160	166
	Total	58887	52183	48930	45556	43641	48490
	Forecast Deviation - %	3.1	-4.0	-3.4	-4.2	-5.9	1.3
Generation -	Hydro	45252	45349	45007	45014	45842	47066
	Thermal	32102	32077	32075	31910	31851	31865
	Other	1113	1116	1121	1122	1133	1122
	Total	78467	78542	78203	78046	78826	80053
Total Unavailable Generation *		2581	2774	3047	4325	4376	3950
Net Firm Transfers - MRO		136	138	171	177	181	174
	RMPA **	-453	-453	-458	-434	-347	-354
	AZ-NM-SNV **	-1359	-1359	-879	-778	-298	-298
	CA-MX **	-77	-77	223	189	189	622
	Total Net Firm Transfers	-1753	-1751	-943	-846	-275	144
Net Generation & Firm Transfers		77639	77519	76099	74567	74725	75959
Margin Over Firm Loads - MW		18912	25496	27329	29171	31244	27635
Margin Over Firm Loads - Percent		32.2	49.0	56.0	64.3	71.9	57.2
ENERGY - GWH							
Total Load		32741	29131	28750	26278	26908	27669
	Forecast Deviation - %	1.2	-2.1	-3.2	-3.7	-1.1	1.1

PEAK DEMAND – MW		JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Loads -	Firm	50903	50415	45690	46921	53727	54240	
	Interruptible & Load Mgt	166	165	160	160	160	160	
	Total	51069	50580	45850	47081	53887	54400	
	Forecast Deviation - %	2.9	2.8	-0.9	-2.3	1.7	-3.8	
Generation -	Hydro	46917	46474	46257	45879	45466	45227	
	Thermal	31879	31874	32165	32481	33134	33157	
	Other	1145	1136	1129	1128	1111	1147	
	Total	79941	79484	79551	79488	79711	79531	
Total Unavailable Generation *		4792	4165	4643	5447	4364	3334	
Net Firm Transfers - MRO		153	168	187	155	125	114	
	RMPA **	-354	-356	-359	-373	-459	-458	
	AZ-NM-SNV **	-298	-298	-298	-1359	-1359	-1359	
	CA-MX **	622	625	625	223	-106	-106	
	Total Net Firm Transfers	123	139	155	-1354	-1799	-1809	
Net Generation & Firm Transfers		75026	75180	74753	75395	77146	78006	
Margin Over Firm Loads - MW		24123	24765	29063	28474	23419	23766	
Margin Over Firm Loads - Percent		47.4	49.1	63.6	60.7	43.6	43.8	
ENERGY - GWH								
Total Load		29759	29291	26665	28109	29590	32422	347313
	Forecast Deviation - %	1.8	1.4	-0.6	0.8	0.9	0.7	-0.2

* Includes Maintenance, Forced Outages, and Inoperable Capability.
** Minus (-) indicates transfer into WECC Region.

Table 16 - Northwest Power Pool Area Estimated Peaks Demands, Resources, and Reserves 2005 - 2014

	SUMMER PEAK							Adverse Hydro Conditions		
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Month	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL	JUL
Loads – Firms	50451	51489	52870	54047	55018	56052	57128	58181	59338	60463
Int. & Load Mgt	215	226	237	248	248	248	248	248	248	248
Total - MW	50666	51715	53107	54295	55266	56300	57376	58429	59586	60711
Growth from Previous Yr. - %	-0.8	2.1	2.7	2.2	1.8	1.9	1.9	1.8	2.0	1.9
Generation ± Transfers - MW	76502	78721	81461	85291	86080	86739	87952	87994	88123	88131
Maint./Inoperable Cap. - MW	2303	2517	1975	2057	2057	2226	2058	2057	1975	1960
Reserve Capability MW	23748	24715	26616	29187	29005	28461	28766	27756	26810	25708
Percent of Firm Peak Demand	47.1	48.0	50.3	54.0	52.7	50.8	50.4	47.7	45.2	42.5

Projected Average Annual Summer Compound Growth Rate (2004-2014) - 1.7%

	WINTER PEAK							Adverse Hydro Conditions		
	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15
Month	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN	JAN
Loads – Firms	58545	59902	60991	61853	62800	63893	64763	65799	66808	67870
Int. & Load Mgt	161	161	161	161	161	161	161	161	161	161
Total - MW	58706	60063	61152	62014	62961	64054	64924	65960	66969	68031
Growth from Previous Yr. - %	2.1	2.3	1.8	1.4	1.5	1.7	1.4	1.6	1.5	1.6
Generation ± Transfers - MW	79835	82306	86198	86901	87822	88813	89534	89549	89553	89553
Maint./Inoperable Cap. - MW	1171	730	730	730	721	721	624	633	624	624
Reserve Capability MW	20119	21674	24477	24318	24301	24199	24147	23117	22121	21059
Percent of Firm Peak Demand	34.4	36.2	40.1	39.3	38.7	37.9	37.3	35.1	33.1	31.0

Projected Average Annual Winter Compound Growth Rate (2004/05-2014/2015) - 1.8%

Table 17 - Northwest Power Pool Area Summary of Generation Additions (Summer Capability - MW)

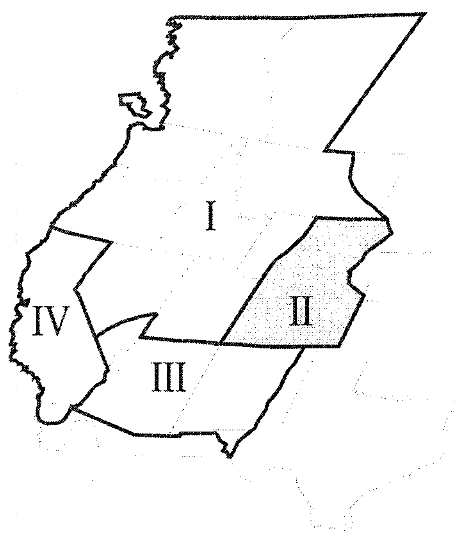
Generation Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	10 Yr. Period	% of Total
Hydro - Conventional	45	123	4	-10	0	500	0	0	0	0	662	5.9
Hydro - Pumped Storage	0	0	0	0	0	0	0	0	0	0	0	0.0
Steam - Coal	-25	37	25	712	268	500	575	0	0	0	2092	18.6
Steam - Oil	0	0	0	0	0	0	0	0	0	0	0	0.0
Steam - Gas	0	0	0	0	0	0	0	0	0	0	0	0.0
Nuclear	0	0	0	0	0	0	0	0	0	0	0	0.0
Combustion Turbine	445	-280	170	0	0	0	0	0	0	0	335	3.0
Combined Cycle	813	1531	3641	0	613	0	0	0	0	0	6598	58.3
Geothermal	0	30	0	0	0	0	0	0	0	0	30	0.3
Internal Combustion	54	0	0	0	0	0	0	0	0	0	54	0.5
Other	254	970	8	274	0	0	0	0	0	0	1506	13.4
Total	1586	2411	3848	976	881	1000	575	0	0	0	11277	100.0

Table 18 - Northwest Power Pool Area Summary of Significant Generation Additions (Summer Capability)

AREA	PLANT NAME / UNIT NO.	LOCATION	UNIT TYPE	NET CAPABILITY MW SUMMER	NET CAPABILITY MW WINTER	FUEL TYPE	IN-SERVICE DATES	STAT	Corr	COMMENTS
NWMT	Milltown 1-5	Clark Fork River	HY	-5	-5	WAT	1-2005	RT	C	Plant to be retired 1-1-2005
NWMT	Thompson River 1	Thompson Falls	OT	12	12	OTH	1-2005	TS	C	Fuel Biomass-Waste Wood & Coal
PACE	Shute Creek CC1	Lincoln Cnty WY	GT	0	0	NG	1-2005	TS	C	Self-generation plant 110 MW
IPC	Fossil Gulch 1-7	Hagerman ID	WT	2	3	WND	2-2005	V	C	Seven 1.5 MW units
IPC	Bennett Mtn 1	Mountain Home ID	GT	165	178	NG	4-2005	V	C	
NWMT	Ranch Pit Wind 28	Great Falls	WT	0	0	WND	4-2005	U	C	Six 1.5 MW turbines
PACE	Currant Creek GT 1-2	Juab Cnty UT	GT	280	280	NG	6-2005	U	C	Owner: PacifiCorp
BPA	Frederickson CC1	Tacoma WA	CC	20	20	NG	7-2005	A	C	Increased duct-firing
NWMT	Rocky Mtn Hardin 1	Hardin MT	ST	109	109	BIT	8-2005	U	C	Developer: Centennial Power
BPA	Klondike II 1	Wasco OR	WT	24	24	WND	12-2005	T	U	Output to PGE, nameplate 75 MW
BPA	Summit/Westward CC1	Clatskanie	CC	503	503	NG	12-2005	P	U	Developer: Westward Energy
BPA	Frederickson CC2	Tacoma WA	CC	290	290	NG	12-2005	P	U	Developer: EPCOR
BPA	CEP Arlington 1	OR	WT	67	67	WND	12-2005	T	U	Columbia Energy Part. 200 MW
BPA	Leaning Juniper 1	OR	WT	67	67	WND	12-2005	T	U	AKA PPM Arlington 200 MW
BPA	Big Horn Wind 1	WA	WT	67	67	WND	12-2005	P	U	Developer: PPM Energy 200 MW
NWMT	Basin Creek 1-9	Butte MT	IC	54	54	NG	12-2005	T	U	Peaking plant
NWMT	Wind Park Sol. 1	Judith Gap MT	WT	15	15	WND	12-2005	T	U	Nameplate = 150 MW
IPC	Emmett Facility 1	Emmett ID	OT	7	7	WDS	1-2006	U	C	Wood-fired steam turbine
PACE	Currant Creek GT 1-2	Juab Cnty UT	GT	-280	-280	NG	5-2006	RP	C	Conversion to CC operation
PACE	Currant Creek CC1	Juab Cnty UT	CC	513	540	NG	5-2006	U	C	Conversion to CC operation
BPA	Hopkins Ridge (83)	Dayton WA	WT	0	0	WND	6-2006	T	U	Output sold to PSE 150 MW
BPA	Wild Horse 130	Ellensburg WA	WT	0	0	WND	6-2006	P	U	Output sold to PSE 220 MW
BPA	Cherry Point CC1	Whatcom Co WA	CC	738	738	NG	6-2006	P	U	Developer: TransCanada
IPC	Raft River GEO 1 1	Malta ID	GE	10	10	GEO	6-2006	U	C	
SPP	Galena 1	Steamboat NV	GE	20	20	GEO	6-2006	T	U	
NWMT	Colstrip 4	Colstrip MT	ST	25	25	BIT	7-2006	A	C	Turbine upgrade
NWMT	MT First MW 1	Great Falls MT	CC	280	280	NG	8-2006	L	U	
NWMT	Colstrip 1	Colstrip MT	ST	12	12	BIT	11-2006	A	C	Turbine upgrade
BPA	Columbia 1	WA	WT	26	26	WND	12-2006	P	U	Developer: Cielo Wind Power
BPA	Roosevelt 1	WA	WT	33	33	WND	12-2006	P	U	
BPA	Orion Wind 1	OR	WT	200	200	WND	12-2006	P	U	
BPA	Combine Hills II 1	OR	WT	35	35	WND	12-2006	T	U	Developer: Eurus
BPA	Seven Mile Hill 1	OR	WT	17	17	WND	12-2006	P	U	
BPA	Shepard's Flat 1-2	OR	WT	333	333	WND	12-2006	P	U	
BPA	Willow Creek 1	WA	WT	60	60	WND	12-2006	P	U	
BPA	Columbia Hills 1	WA	WT	42	42	WND	12-2006	P	U	
BPA	Klondike Phase 3 1	OR	WT	100	100	WND	12-2006	P	U	
BPA	Windtricity 1	WA	WT	50	50	WND	12-2006	T	U	
BPA	White Creek 1	WA	WT	67	67	WND	12-2006	P	U	
PGE	Port Westward CC1	Clatskanie OR	CC	356	425	NG	5-2007	U	C	
PACE	Summit-Lake Side CC1	Vineyard	CC	540	580	NG	6-2007	T	U	Devel: Summit Vineyard LLC
NWMT	Colstrip 3	Colstrip MT	ST	25	25	BIT	7-2007	A	C	Turbine upgrade
BPA	Wanapa CC1	Umatilla Cnty OR	CC	630	630	NG	9-2007	P	U	Umatilla Confederated Tribes
BPA	Wanapa CC2	Umatilla Cnty OR	CC	630	630	NG	9-2007	P	U	Umatilla Confederated Tribes
BPA	Plymouth CC1	Plymouth WA	CC	335	335	NG	9-2007	P	U	Developer: Plymouth Energy
BPA	COB EF CC1	Klamath Cnty OR	CC	575	575	NG	9-2007	L	U	Developer: Peoples Energy
BPA	COB EF CC2	Klamath Cnty OR	CC	575	575	NG	9-2007	L	U	Developer: Peoples Energy
NWMT	N. Alt. Energy 1	Whitehall MT	WT	8	8	WND	12-2007	P	U	Nameplate = 75 MW
NWMT	Bull Mountain 1	Broadview MT	ST	700	700	LIG	3-2008	P	U	
PACE	Two Elk 1	Campbell Cnty WY	OT	274	282	WC	4-2008	P	U	Owner: North Amer. Power Group
NWMT	Colstrip 2	Colstrip MT	ST	12	12	BIT	7-2008	A	C	Turbine upgrade
PACW	Condit 1-2	Klickitat County	HY	-14	-14	WAT	10-2008	RT	C	
NWMT	Southern MT Elec. 1	Great Falls	ST	268	268	LIG	3-2009	P	U	
PACE	Wasatch Front CC2	Vineyard UT	CC	513	540	NG	4-2009	P	U	Developer: PacifiCorp
NWMT	MT Lignite 1	Colstrip MT	ST	500	500	LIG	4-2010	P	U	
PACE	Hunter 4	Emery Cnty UT	ST	575	575	BIT	6-2011	P	U	Developer: PacifiCorp
			CANADIAN SYSTEMS - ALBERTA							
AESO	Wabamun 1-2	Wabamun AB	ST	-134	-134	SUB	1-2005	RT	C	Planned retirement
AESO	Kettles Hill WF 1	Pincher Creek	WT	0	0	WND	12-2005	P	U	Benign Energy phase 1 = 9MW
AESO	P Springs 1-60	AB	WT	0	0	WND	12-2005	P	U	Shell/Enmax nameplate = 80MW
AESO	Summerview WF 2	Pincher Creek	WT	0	0	WND	4-2006	P	U	Vision Quest, phase 2 = 60MW
AESO	Blue Trail WF 1-40	AB	WT	0	0	WND	6-2006	U	C	Vision Quest, nameplate = 60MW
AESO	Kettles Hill WF 2	Pincher Creek	WT	0	0	WND	7-2006	P	U	Benign Energy phase 2 = 54MW
AESO	Long Lake 1-2	Ft. McMurray AB	GT	170	170	NG	1-2007	U	C	
AESO	Syncrude UE1 11-12	Ft. McMurray	CC	100	100	NG	9-2009	P	U	
			CANADIAN SYSTEMS - BRITISH COLUMBIA							
BCHA	Upper Mamquam 1	Squamish BC	HY	25	3	WAT	6-2005	V	C	Dev: Canadian Hydro
BCHA	Waneta 4	Pend Oreille R BC	HY	25	25	WAT	10-2005	A	C	Turbine upgrade/life extension
BCHA	Brilliant Exp 1	Kootenay R BC	HY	120	120	WAT	8-2006	U	C	
BCHA	L Bonnington 3	Kootenay R BC	HY	3	3	WAT	10-2006	A	C	Turbine upgrade/life extension
BCHA	S Slocan 1	Kootenay River BC	HY	2	2	WAT	6-2007	A	C	Turbine upgrade/life extension
BCHA	Corra Linn 1	Kootenay River BC	HY	2	2	WAT	12-2007	A	C	Turbine upgrade/life extension
BCHA	S Slocan 3	Kootenay River BC	HY	2	2	WAT	5-2008	A	C	Turbine upgrade/life extension
BCHA	Corra Linn 2	Kootenay River BC	HY	2	2	WAT	12-2008	A	C	Turbine upgrade/life extension
BCHA	Revelstoke 5	Columbia River BC	HY	500	500	WAT	10-2010	P	U	

See the appendix for a description of the unit type codes, status codes, and the committed/uncommitted codes.

Rocky Mountain Power Area (RMPA)



Aquila Networks – WPC	WPE
Arkansas River Power Authority	ARPA
Basin Electric Power Cooperative	BEPC
Black Hills Power	BHP
Colorado Springs Utilities	CSU
Municipal Energy Agency of Nebraska	MEAN
Platte River Power Authority	PRPA
Public Service Company of Colorado	PSC
Tri-State Generation & Transmission Association, Inc.	TSGT
U.S.B.R. Great Plains Region	USGP
U.S.B.R. Upper Colorado Region	USUC
Western Area Power Administration - Golden Colorado Area	WAHQ
Loveland Area	WACM

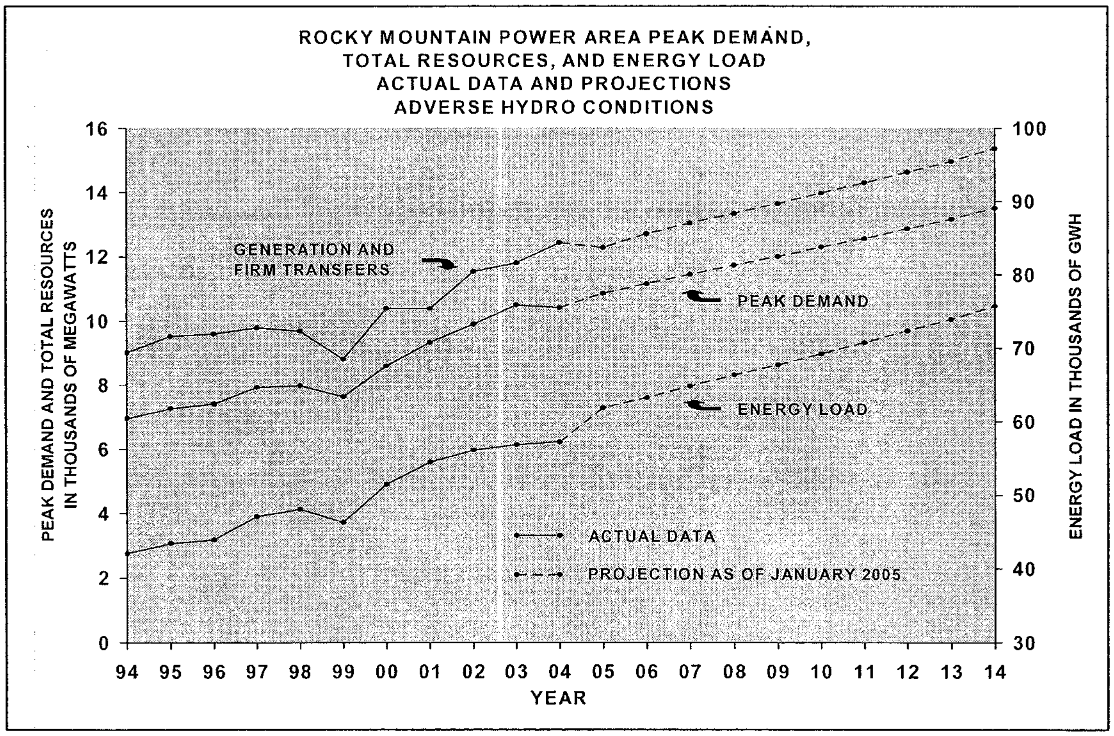


Figure 8

Table 19 - Rocky Mountain Power Area Actual Loads and Resources for 2004

PEAK DEMAND – MW		JAN	FEB	MAR	APR	MAY	JUN
Loads -	Firm	8751	8332	7561	7035	7778	9408
	Interruptible & Load Mgt	135	155	134	183	185	149
	Total	8886	8487	7695	7218	7963	9557
	Forecast Deviation - %	5.8	2.4	-4.0	-2.6	-3.9	2.8
Generation -	Hydro	1273	1273	1273	1303	1303	1303
	Thermal	10986	10986	10986	10806	10609	11259
	Other	22	22	22	22	22	22
	Total	12281	12281	12281	12131	11934	12584
Total Unavailable Generation *		676	240	287	1165	1294	455
Net Firm Transfers - MRO **		-117	-105	-116	-53	13	-1
	NWPP	364	279	414	348	257	283
	AZ-NM-SNV **	-204	-204	-204	-161	-161	-161
	Total Net Firm Transfers	43	-30	94	134	109	121
Net Generation & Firm Transfers		11562	12071	11900	10832	10531	12008
Margin Over Firm Loads - MW		2811	3739	4339	3797	2753	2600
Margin Over Firm Loads - Percent		32.1	44.9	57.4	54.0	35.4	27.6
ENERGY - GWH							
Total Load		4997	4600	4579	4382	4658	4669
	Forecast Deviation - %	1.9	1.9	0.7	3.1	10.1	5.4

PEAK DEMAND – MW		JUL	AUG	SEP	OCT	NOV	DEC	
Loads -	Firm	10222	9448	8528	7139	8553	8846	
	Interruptible & Load Mgt	178	198	158	104	125	125	
	Total	10400	9646	8686	7243	8678	8971	
	Forecast Deviation - %	1.3	-2.6	-2.7	-8.6	3.5	1.6	
Generation -	Hydro	1303	1303	1303	1273	1273	1273	
	Thermal	11251	11251	11259	11652	11652	11652	
	Other	22	22	22	22	22	22	
	Total	12576	12576	12584	12947	12947	12947	
Total Unavailable Generation *		201	514	514	1968	543	282	
Net Firm Transfers - MRO **		-10	-20	-13	-15	-116	-121	
	NWPP	317	248	267	285	391	206	
	AZ-NM-SNV **	-161	-161	-161	-204	-204	-204	
	Total Net Firm Transfers	146	67	93	66	71	-119	
Net Generation & Firm Transfers		12229	11995	11977	10913	12333	12784	
Margin Over Firm Loads - MW		2007	2547	3449	3774	3780	3938	
Margin Over Firm Loads - Percent		19.6	27.0	40.4	52.9	44.2	44.5	
ENERGY - GWH								TOTAL
Total Load		5324	5113	4599	4484	4674	5135	57214
	Forecast Deviation - %	3.9	-0.2	-1.8	2.2	5.8	4.6	3.1

* Includes Maintenance, Forced Outages, and Inoperable Capability.
** Minus (-) indicates transfer into WECC Region.

b

Only the following portions of this document were relied upon as Source Documents for Joe Gorberg testimony at the May 1-2, 2007 hearing. Copies of the balance of this document will be furnished upon request, but were not copied to reduce the volume of paper in this supplement.

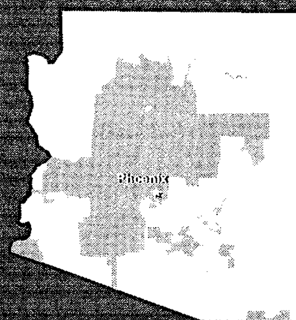
Credit Suisse
2007 Energy Summit
February 6, 2007

PINNACLE WEST
CAPITAL CORPORATION

Forward-Looking Statements

This presentation contains forward-looking statements. Neither the Company nor APS assumes any obligation to update these statements or make any further statements on any of these issues, except as required by applicable law. These forward-looking statements are often identified by words such as "estimate," "predict," "hope," "may," "believe," "anticipate," "plan," "expect," "require," "intend," "assume" and similar words. Because actual results may differ materially from expectations, we caution readers not to place undue reliance on these statements. A number of factors could cause future results to differ materially from historical results, or from results or outcomes currently expected or sought by Pinnacle West or APS. In addition to the Risk Factors described in Item 1A of the Pinnacle West/APS Annual Report on Form 10-K for the fiscal year ended December 31, 2005, these factors include, but are not limited to, state and federal regulatory and legislative decisions and actions, including the outcome and timing of APS' retail rate proceedings pending before the ACC; the timely recovery of PSA deferrals, including such deferrals in 2005 and 2006 associated with unplanned Palo Verde outages and reduced power operations that are the subject of ACC prudence reviews; the ongoing restructuring of the electric industry, including the introduction of retail electric competition in Arizona and decisions impacting wholesale competition; the outcome of regulatory, legislative and judicial proceedings, both current and future, relating to the restructuring; market prices for electricity and natural gas; power plant performance and outages; transmission outages and constraints; weather variations affecting local and regional customer energy usage; customer growth and energy usage; regional economic and market conditions, including the results of litigation and other proceedings resulting from the California energy situation, volatile fuel and purchased power costs and the completion of generation and transmission construction in the region, which could affect customer growth and the cost of power supplies; the cost of debt and equity capital and access to capital markets; current credit ratings remaining in effect for any given period of time; our ability to compete successfully outside traditional regulated markets (including the wholesale market); the performance of our marketing and trading activities due to volatile market liquidity and any deteriorating counterparty credit and the use of derivative contracts in our business (including the interpretation of the subjective and complex accounting rules related to these contracts); changes in accounting principles generally accepted in the United States of America and the interpretation of those principles; the performance of the stock market and the changing interest rate environment, which affect the value of the assets in the trusts holding our nuclear decommissioning, pension, and other postretirement benefit plans assets, the amount of required contributions to Pinnacle West's pension plan and contributions to APS' nuclear decommissioning trust funds, as well as the reported costs of providing pension and other postretirement benefits; technological developments in the electric industry; the strength of the real estate market in SunCor's market areas, which include Arizona, Idaho, New Mexico and Utah; and other uncertainties, all of which are difficult to predict and many of which are beyond the control of Pinnacle West and APS.

APS Retail Service Territory



APS Retail Service Territory

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Arizona Population Highlights

- Arizona's population 6.2 million
- Arizona 16th largest state
- Arizona 16.3% population change since 2001
- Arizona's population expected to reach 10.7 million by 2030
- Phoenix 5th largest city in U.S.

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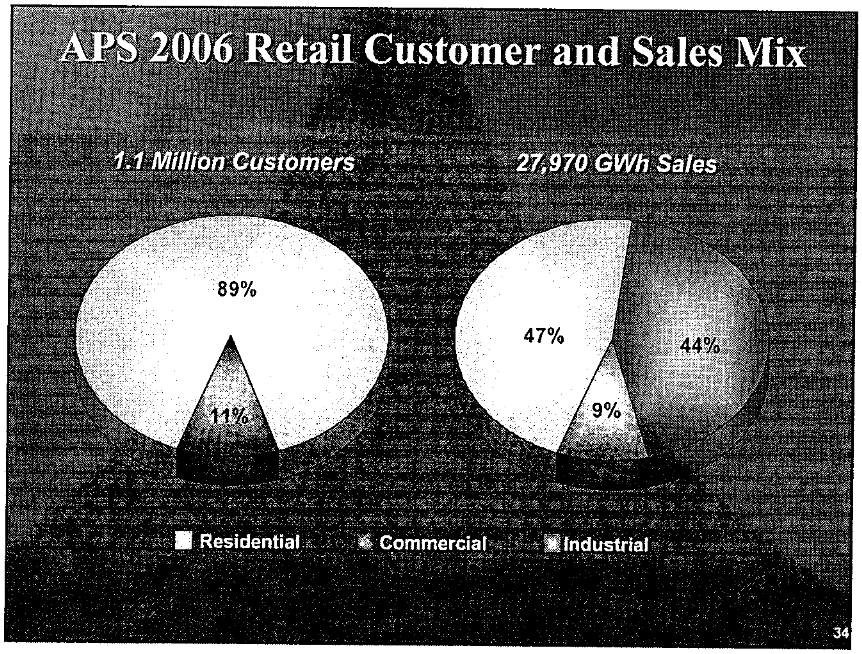
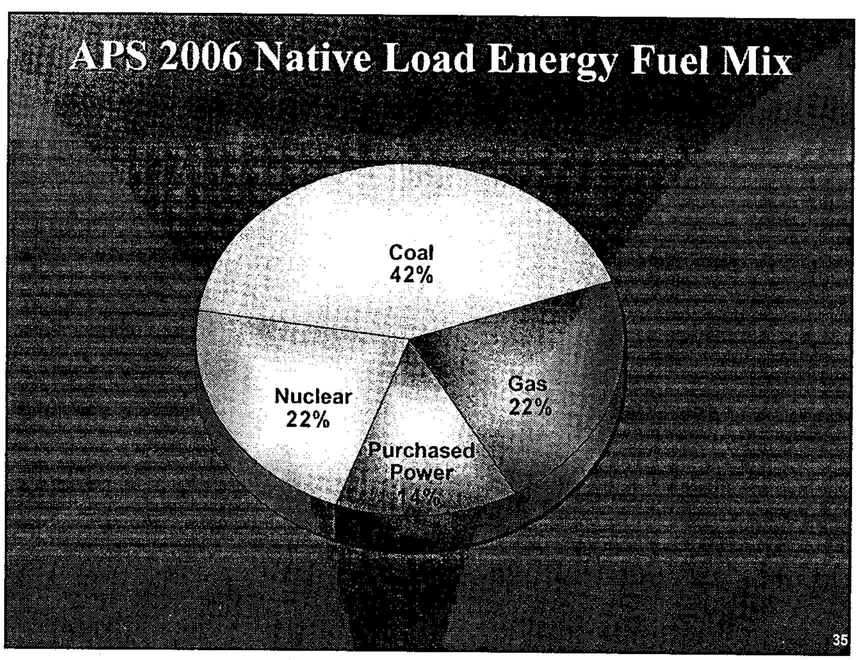
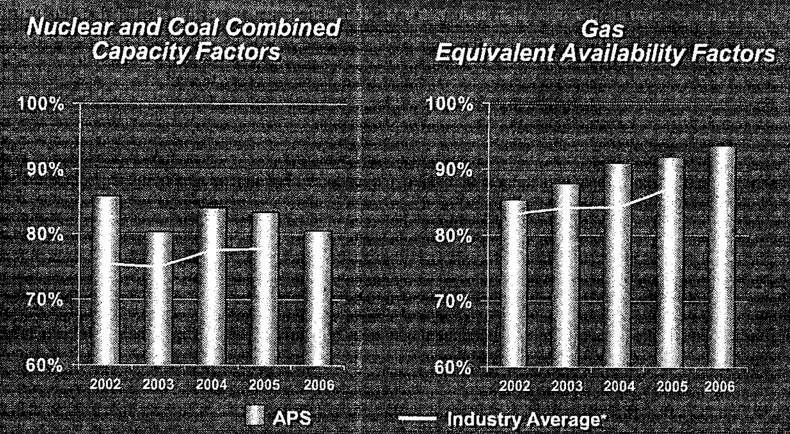

APS 2006 Retail Customer and Sales Mix
1.1 Million Customers
27,970 GWh Sales
89%
11%
47%
44%
9%
Residential
Commercial
Industrial
34


APS 2006 Native Load Energy Fuel Mix
Coal 42%
Gas 22%
Nuclear 22%
Purchased Power 14%
35

Generation Operating History



* Latest available

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APS Baseload Capacity RFP

Requirements

- Delivery as early as 2009 but no later than 2014
- Equity ownership or purchase power agreement
- 100 - 500 MW of capacity per proposal
- Ability to operate at or above 85% capacity factor

Schedule

- Proposals received July 2006
- Shortlist notification October 2006
- Completion expected in 2007

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c

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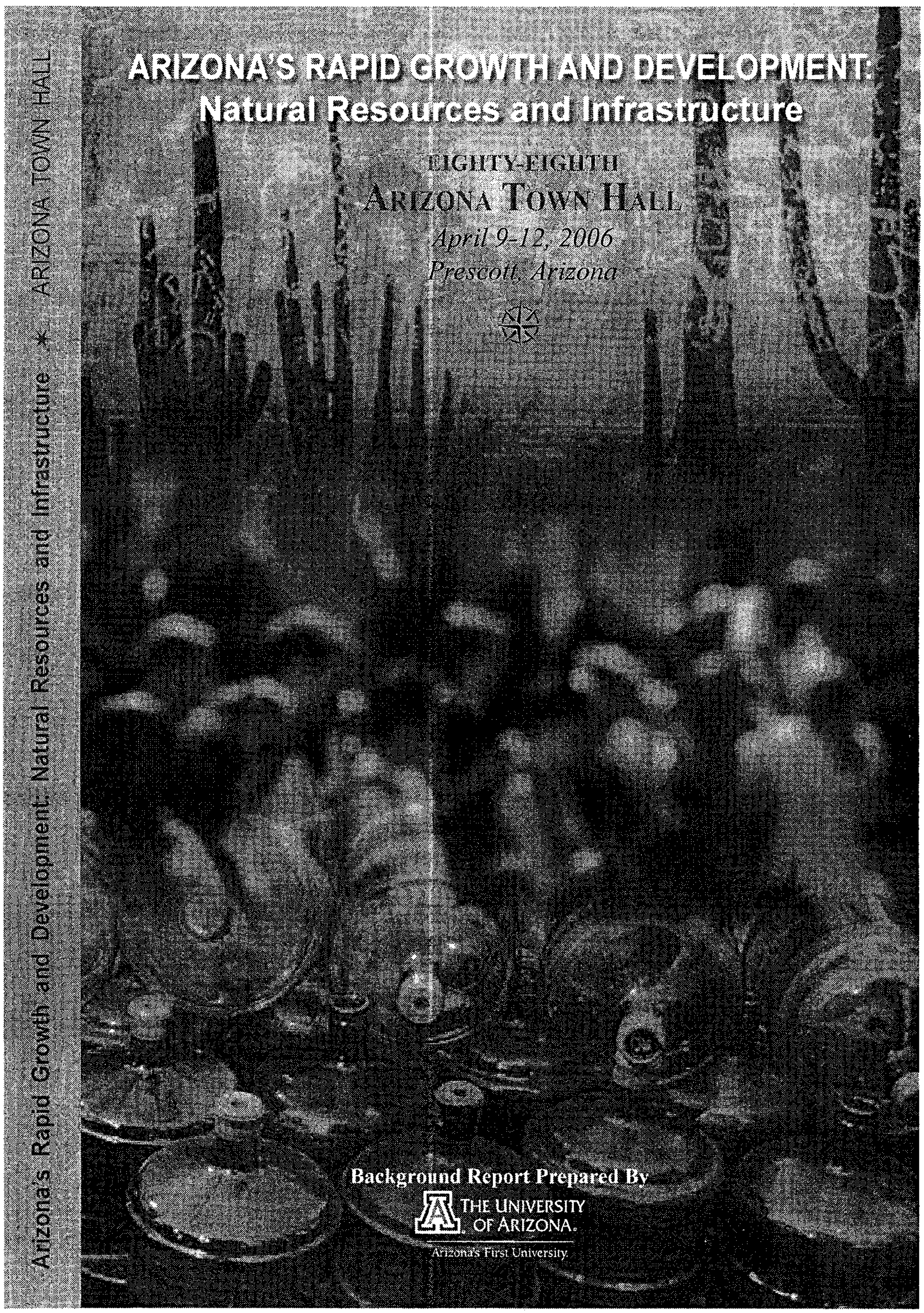
ARIZONA'S RAPID GROWTH AND DEVELOPMENT:
Natural Resources and Infrastructure
EIGHTY-EIGHTH
ARIZONA TOWN HALL
April 9-12, 2006
Prescott, Arizona
Background Report Prepared By
THE UNIVERSITY OF ARIZONA.
Arizona's First University.
Arizona's Rapid Growth and Development: Natural Resources and Infrastructure * ARIZONA TOWN HALL

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TABLE 3.8

FY 2000 RAIL PASSENGER RIDERSHIP

(in hundreds)

City	Service	Passengers
Phoenix	Amtrak (Sunset Limited)	8.0
Benson	Amtrak (Sunset Limited)	1.9
Tucson	Amtrak (Sunset Limited)	25.9
Yuma	Amtrak (Sunset Limited)	2.5
Winslow	Amtrak (Southwest Chief)	2.2
Flagstaff	Amtrak (Southwest Chief)	44.9
Williams	Amtrak (Southwest Chief)	5.0
Kingman	Amtrak (Southwest Chief)	3.1
Grand Canyon	Grand Canyon Railway Co.	190.0
Clarkdale	Arizona Central Railway Co.	72.0

Note: Phoenix passengers are bused to Tucson Depot.
Source: ADOT, *Arizona Transportation Factbook,* 2002.

An overview of the commodities transported by rail in Arizona is given in Table 3.9. The state's principal freight lines are the Burlington Northern Santa Fe (BNSF) in the north, and the Union Pacific in the south. The BNSF serves Kingman, Seligman, Williams Junction, Flagstaff, Winslow and Holbrook. Around 60 to 70 trains move over the line every day. The BNSF also operates a branch line to Phoenix from Williams Junction, with about six to eight trains a day. The Union Pacific serves Yuma, Gila Bend, Maricopa, Casa Grande, Tucson, Benson and San Simon with about 40 to 50 trains per day. The Union Pacific also operates a secondary line that runs from Wellton through Phoenix and back to the main line at Picacho. A portion of this line between Wellton and Buckeye is out of service, but four to six trains move daily between Phoenix and Picacho. The legislature has authorized the Arizona Department of Transportation (ADOT) to use vehicle license tax funds to preserve the Wellton/Buckeye corridor, parts of which are owned by the railroad, the state and the U.S. Bureau of Land Management.

TABLE 3.9

GENERAL COMMODITIES TRANSPORTED

Railroad	Commodities
Burlington Northern Santa Fe	Intermodal (80%), Mixed Freight (20%)
Union Pacific	Intermodal (60%), Mixed Freight (40%)
Black Mesa & Lake Powell	Coal (100%)
Coronado	Coal (100%)
Apache	Paper (40%), Grain (30%), Chemicals (30%)
Arizona & California	Mixed Freight (85%), Chemicals (15%)
Arizona Central	Passengers (95%), Coal (5%)
Arizona Eastern	Copper Products (100%)
Copper Basin	Copper Products (100%)
Grand Canyon	Passengers (100%)
Magma*	NA
San Manuel*	NA
San Pedro & Southweestern	Chemicals (90%), Copper Products (10%)
Tucson Cornelia & Gila Bend*	NA

*Currently out of service.
Source: ADOT, *Arizona Transportation Factbook*, 2002.

There are approximately 23 intermodal rail facilities in Arizona. Six of these are lightly used team tracks where trucks park next to rail cars, and transloading is carried out manually or by forklift. The major intermodal facilities are the BNSF's Glendale Intermodal Yard, which handles about 60,000 carloads every year, and the El Mirage automobile distribution facility, which handles between 150,000 and 180,000 cars each year.

The Union Pacific's Phoenix Intermodal Yard handles 43,000 carloads annually, and their Phoenix Auto Yard around 4,800 auto carriers. Union Pacific no longer maintains an intermodal facility in Tucson. Truckload shipments originating there must be driven to Phoenix to be loaded on trains there, thus adding to traffic on I-10. There are smaller intermodal facilities operated by the Arizona & California Railroad in Parker and by the San Pedro & Southwestern Railroad at Bisbee Junction.

Urban Transit

There are two major fixed-route bus transit systems in Arizona. Valley Metro, in the Phoenix area, carries approximately 135,000 passengers daily, and Sun Tran, in Tucson, carries around 60,000 passengers per day. While ridership on Valley Metro has shown robust growth in recent years, up more than one-third from 1999 to 2003, Sun Tran ridership has remained essentially flat over the same time period. On the other hand, Sun Tran ridership did increase 6.5 percent during 2004 while transit ridership declined nationally. Several other smaller cities in Arizona operate fixed-route systems, including Flagstaff, Show Low, Sierra Vista and Yuma. The Navajo Nation and the Hopi Tribe also operate transit services. Coolidge and Lake Havasu City operate dial-a-ride systems. Dial-a-ride and paratransit services for the handicapped also are important parts of the Valley Metro and Sun Tran operations.

The Valley Metro Rail light-rail system is currently under construction, funded as part of a transportation plan in a November 2004 ballot proposition. Its minimum-operating segment will be 20 miles long, running from central Phoenix through Tempe and into west Mesa for about one mile. This segment is scheduled to begin operation at the end of 2008. Also approved as part of Proposition 400 were about 30 miles of extensions to this initial segment, which will run into west and north Phoenix, Glendale and farther into Mesa.

Intercity Bus Service

The principal carrier of intercity bus traffic in Arizona is Greyhound Lines. It provides service at least once a day on most of the major corridors. A growing number of locally-owned operations offer airport limousine services between Phoenix and Tucson, between Tucson and Nogales and other points in southeastern Arizona, and between Phoenix and the more distant communities of Prescott, Sedona and Yuma. Currently there is no bus service between Flagstaff and Page.

Ports of Entry

There are 22 ports of entry in Arizona, with six of these on the Mexican border. Apart from regulating the flow of people and private vehicles across the border, these entry points must also monitor commercial vehicles for registration, motor taxes, size and weight restrictions, vehicle safety, licensing and insurance. In this respect the Nogales facility is by far the state's largest. In 2000 Nogales processed more than 250,000 truck crossings San Luis around 40,000 and Douglas about 34,000. Nogales is the only major port in Arizona that can accommodate imports by rail. In fact, only Laredo, Texas processes more tons of northbound trade by rail than does Nogales. Although the number of trains crossing the border at Nogales has fallen somewhat in recent years, their length has more than doubled, from an average of 48 containers per train in 1996 to 106 in 2004. The port also is processing a greater percentage of full containers. By value, automobiles account for about three-quarters of the commodities entering the country by rail at Nogales, followed distantly by various copper products and copper ore (9.8 percent), beer (7.6 percent) and portland cement (2.5 percent). The Nogales port of entry is currently being redesigned to accommodate increasing flows of goods and people, both more efficiently and more securely. The Nogales CyberPort Project, commissioned by the Governor's CANAMEX[1] Task Force in Spring 2002, is responding to the need for a more secure Mariposa port of entry following the September 11, 2001 attack. In addition the project seeks to improve the entire trade flow process and reduce commercial traffic bottlenecks. Improvements also are underway at ports of entry in Yuma and Cochise Counties.

TRANSPORTATION PLANNING AND FUNDING

State law empowers the State Transportation Board to set priorities for individual highway and airport projects and award all highway contracts. The Board is made up of seven members appointed by the governor from each of six transportation districts, including two members from district one, Maricopa County.

For planning purposes, Arizona is divided into several planning and development districts. Councils of Governments (COGs) have been established in these districts by agreement among the local governments within each area for the purposes of coordinating comprehensive planning on an area-wide or regional basis (Figure 3.9). ADOT recognizes and assists these COGs as area-wide transportation planning agencies through the provision of its technical and financial support. ADOT also provides advisory assistance to the non-metropolitan COGs through its local assistance program. Transportation planning funds are made available by ADOT to all the rural COGs.

The Maricopa Association of Governments (MAG), Pima Association of Governments (PAG), Flagstaff Metropolitan Planning Organization, Central Yavapai Metropolitan Planning Organization and Yuma Metropolitan Planning Organization are designated by the governor as the Metropolitan

[1] CANAMEX is a 1,504 miles federally designated "high priority" trade corridor that facilitates the flow of trade and tourism between Canada and Mexico through the western states of Montana, Idaho Utah, Nevada and Arizona.

Planning Organizations (MPOs) for the Phoenix, Tucson, Flagstaff, Prescott and Yuma metropolitan areas. As such, these agencies are responsible for developing comprehensive long-range transportation plans. Specific transportation planning responsibilities of the COGs are outlined in their annual work programs, which are approved at local, state and federal levels. Their typical planning activities include: the development of goals and objectives, issue review, data collection and analysis, forecasting needs and deficiencies, developing alternative plans and carrying out special transportation studies. Public input and impact analysis also are important aspects of regional transportation planning.

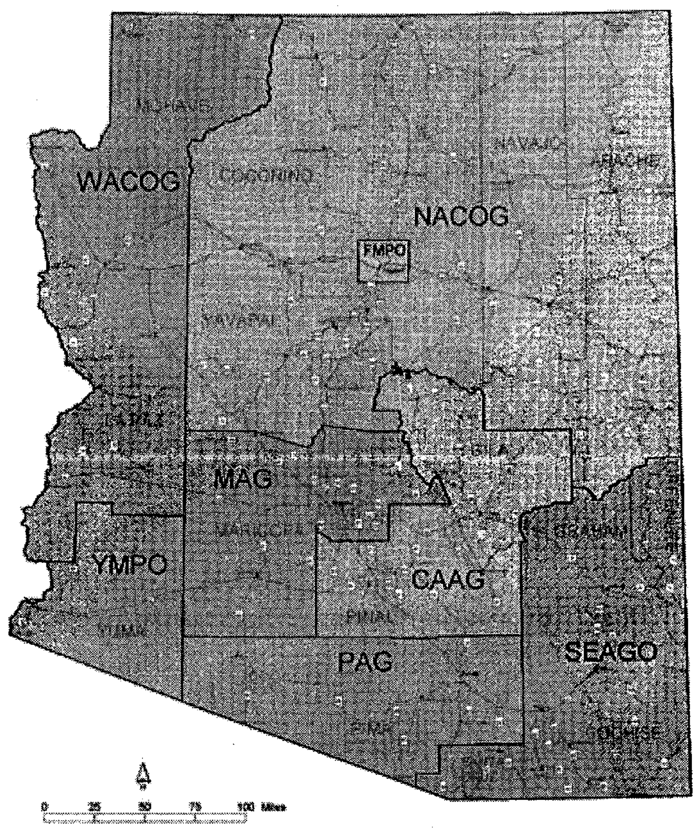
The major source of funding for the construction and improvement of the state's highways and bridges is the Highway User Revenue Fund (HURF). The HURF serves as the depository for state taxes and fees relating to the operation of motor vehicles. These are, in descending order of importance: gasoline taxes, currently 18 cents per gallon; vehicle license taxes, based on the value of the vehicle being taxed; use fuel taxes, a tax on diesel fuel that varies from 18 cents per gallon for passenger cars to 26 cents per gallon for commercial trucks and buses; and motor carrier fees. Of these sources for the HURF, only one, the vehicle license tax, is tied to the rate of inflation, and the rate has been reduced in recent years. These revenues are distributed from the HURF through ADOT to each city and region based upon its size relative to others.

Federal funds are apportioned in accordance with the Transportation Equity Act for the 21st Century (TEA-21). TEA-21 requires that all urban areas with a population over 50,000 have a transportation plan based on a coordinated, comprehensive and continuing planning process. This requirement is the responsibility of the designated MPO. TEA-21 funds are available for road construction, maintenance and safety, bridge replacement and rehabilitation, rail-highway crossing improvements and planning and research.

Several metropolitan areas in Arizona have voter-approved Regional Area Road Fund (RARF) programs that raise money for transportation improvements through sales taxes. Maricopa, Yavapai and Pinal Counties have RARFs, and the Flagstaff metropolitan area also is raising funds for specific transportation projects through local taxes.

Airport funding is generated from two sources in Arizona, the federal Airport Improvement Program (AIP) and the State Aviation Fund. The AIP relies on user fees to address deficiencies in safety, security and capacity. Less than half of the funding of Arizona's primary airports currently comes from this source, however, and none of the secondary airports are eligible to receive it. The State Aviation Fund, administered by ADOT, relies mainly on

FIGURE 3.9
COUNCILS OF GOVERNMENTS



Source: ADOT, Intermodal Transportation Division, 1999.

revenues from the flight property tax, the aircraft license tax, the aviation fuel tax and Grand Canyon Airport revenues.

In the past some funding for railroads has come from the Federal Railroad Administration's Local Rail Freight Assistance Program. No funds have been appropriated for this program since 1994, however. TEA-21 does contain provisions for reviving the program, with priority for projects that address safety, environmental concerns, economic development and the preservation or enhancement of small communities and rural areas. There are currently no state funds dedicated to railroad transportation. Absent the availability of federal funds, Arizona's rail lines are obliged to fund their own capital and maintenance projects.

The federal government funds capital and operating assistance programs for urban transit. MPOs, such as those in Flagstaff and Yuma, can serve as conduits for directing these funds to local operators. Larger cities, however, receive their federal funds directly. ADOT administers two federally funded rural transit programs. The Section 5311 program assists rural transit operations, and the Section 5310 program assists transportation services for the elderly and persons with disabilities. Local governments in the Phoenix metro area also have enacted sales taxes dedicated to transit projects.

One local source of transportation funding in Arizona deserves special mention. In 1985 voters in Maricopa County approved a one-half cent transportation excise tax for the construction of controlled-access highways. This enabled a near doubling of the freeway system in the MAG region, which has added nearly 1,000 new lane-miles since then. In 2004 the voters approved the extension of this tax for another 20 years, which is expected to raise approximately $9 billion over this two-decade span, allowing for the growth of the freeway system by another 50 percent, with the addition of well over 1,000 new lane-miles. Under the voter-approved plan, 56 percent of the tax revenue is allocated to freeways, public transit receives about one-third, to be split almost equally between bus and rail, and streets nine percent. The remainder is dedicated to safety planning, bike paths and walkways. Last fall voters in Pinal County approved a similar measure, which is projected to raise nearly $1 billion dollars for transportation over its 20-year life span.

On May 16, 2006, residents of Pima County approved a 20-year Regional Transportation Authority Expenditure Plan, based on a one-half cent transportation sales tax. The $2.1 billion plan allocates 58 percent to roadway improvements (200 new lane miles), 27 percent for transit improvements, nine percent for safety improvements and six percent for environmental and economic vitality.

STRAINS IN THE CURRENT SYSTEM

Highways

Despite this highly articulated planning structure and the variety of funding sources now in place, population growth in Arizona is already overcoming some of the state's principal roadways. Arizona is not yet adequately considering the growth that is coming in the next twenty-five years; essentially only that growth which has already occurred, especially in the last decade or less, and especially in the Phoenix metro area, is being addressed. In this region the strains are most evident in commuter traffic in the newly developing "Pinal Horseshoe" in the southeast valley, along I-10 in the west valley and along I-17 in the north. These examples are offered only as illustrations of the current strains.

The "Pinal Horseshoe," a crescent arcing around the southeastern edge of the Gila River Indian Community in Pinal County, has experienced explosive population growth in just the last few years, as many homebuyers with jobs in the Phoenix area have followed the "drive until you qualify" strategy. Now, as county and ADOT officials are struggling to come to terms with the new reality, those buyers are discovering a more difficult drive than they perhaps had in mind when they bought their new homes. At the west end of the horseshoe, for example, traffic counts at Maricopa Road (Arizona SR 347) and I-10 nearly doubled between 2002 and 2004; at the intersection of Maricopa Road and Casa Grande Highway counts more than tripled in the same period; at the eastern end, at the intersection of Hunt Highway and Thomson Road counts rose from 2,400 cars per day in 2000 to over 20,000 in 2005. Many of the roads in this area are relatively narrow and often interrupted by four-way stops—an essentially rural infrastructure not designed to handle the heavy traffic of urban commuters. Traffic citations have increased dramatically, as have accidents.

I-10, along a nine-mile stretch between the Loop 101 to the Loop 303 in the west valley communities of Goodyear and Avondale, had a fatality rate of 1.56 per mile in 2004. This makes it one of the deadliest pieces of the highway in the entire country. For comparison, I-10 as a whole averages 0.19 fatalities per mile; in Arizona it averages 0.30 fatalities per mile; and in the Phoenix metro area, including Goodyear and Avondale, it averages 0.71 fatalities per mile. A major reason for this exceptionally dangerous situation is the bottleneck at the mid-point of this nine-mile stretch where I-10 westbound narrows to two lanes each way—another essentially rural system, in other words, being asked to do duty as a throughway for heavy urban commuting traffic. Once again, explosive population growth in the west valley communities of Litchfield Park, Goodyear and Buckeye has created a problem far in advance of what transportation planners foresaw. According to the construction schedule in MAG's Regional Transportation Plan, widening of this part of I-10 will not begin until 2011.

Suburban growth, however, is not always to blame for deteriorating road conditions. I-17 north of Phoenix was built in the late 1950s and early 1960s as a rural highway connecting a much smaller metropolitan area with a sparsely populated area in the north of the state. For most of its length it has remained essentially unchanged since then. North of Phoenix, now the sixth largest metropolitan area in the country, I-17 narrows from six lanes and a high occupancy vehicle lane to only four just south of Pinnacle Peak Road. Pinnacle Peak is two miles north of the Loop 101, and a full 12 miles south of Anthem, another major contributor to the congestion. Traffic counts at Pinnacle Peak Road have more than doubled in the last ten years, and accidents between that point and Cordes Junction, about 45 miles to the north, have increased from around 300 in 1994 to nearly 750 in 2005. Current ADOT plans do not call for any major expansion of I-17 until after 2020, and even then the improvements will extend only as far as Anthem.

Another sort of strain on the current system is time: the inevitable costs imposed by delays in highway improvement. MAG's 2006 schedule of freeway building had to be altered due to an unexpected rise in construction costs. Bids for projects came in nearly 20 percent higher than anticipated because of shortages in critical commodities, such as cement, brought on in part by general increases in demand as well as demand generated by Hurricane Katrina reconstruction. The result is that some projects, such as the bypass around downtown Wickenburg, have had to be put off, and delays always mean higher costs in the end. Planners hope that booming population growth in the Phoenix metro area also will create transportation tax revenues higher than originally anticipated, so they can catch up with the original work schedule by 2010.

Sky Harbor International Airport

In the year 2000 Sky Harbor ranked third worst in the nation in departure delays caused by airport conditions, behind Newark and La Guardia. Delays had more than doubled since 1998. One of the major causes was air pollution, which caused more delays in Phoenix than rain did in Seattle. Parking at Sky Harbor continues in short supply, creating more pressures for off-site options. Tempe residents continue to voice concerns over airport noise, in particular as plans for a fourth runway begin to be contemplated. In 2001 Sky Harbor started to seek approval for a new West Terminal, to have a 33-gate capacity, again over objections from Tempe. Approval for this new terminal is not yet final, and it would not open until 2011 at the earliest. Expansion at Sky Harbor also depends on maintaining height restrictions on urban development nearby. The City of Phoenix has recently approved new rules that give the safety of present and any future flight paths priority over real estate development, but the City of Tempe has not followed suit. Intra-metropolitan differences like these could have the effect of either impeding the development of new capacity at Sky Harbor, currently the fifth-busiest airport in the country, or shifting new capacity to alternative locations.

FUTURE TRANSPORTATION NEEDS

Highways

According to the Governor's Transportation Vision 21 Task Force, which submitted its final report in December 2001, the number of daily vehicle miles driven in the Phoenix and Tucson metro areas will grow by more than 50 percent by 2020. Vision 21 also predicted that traffic volume along I-10 between these two cities would double in the same period. Clearly Arizona is on its way to a severe, and costly, transportation problem on its major roadways. A recent study found that increased fuel consumption and lost time due to congestion already amounts to a cost of $540 per capita in the Phoenix metro area and $395 per capita in Tucson. PAG predicts that, even assuming all its roadway improvements are built, the percentage of vehicle miles driven in the region under conditions of either severe or heavy congestion will double in the period from 2000 to 2025, rising from 27 percent to 54 percent. Travel on state highways also is becoming increasingly congested. Table 3.10 shows the growth in numbers of commercial trucks on all Arizona interstates from 1990 to 2000, a decade that saw an increase in this traffic of 105 percent. There is no reason to expect this trend to change over the next 20 years.

TABLE 3.10

ANNUAL COMMERCIAL VEHICLE COUNTS

(trucks greater than 26,000 gross vehicle weight)

Year	I-8	I-10	I-17	I-19	I-40	Total
1990	39,989	948,200	307,200	31,400	313,300	1,640,089
1995	39,234	1,567,100	486,400	38,600	364,000	2,495,334
2000	61,900	2,002,700	598,800	80,200	610,700	3,354,300

Source: ADOT, *Vision 21*.

Aviation

According to the *State Aviation Needs Study (SANS), 2000*, commercial passenger enplanements in Arizona are expected to grow 79 percent between 2000 and 2020, reaching a total of more than 31 million annually at Sky Harbor, and about 3.5 million at Tucson International. Air cargo operations at Sky Harbor are expected to triple by 2020 and double at Tucson. At rural airports, on the other hand, passenger service is declining due to "leakage"—the tendency of passengers to travel to larger airports with better service—and will likely continue to do so into the future.

Passenger Rail

Phoenix is currently the largest urban area in the country without passenger rail service, and Amtrak has no plans to return service to the city. Other ideas for passenger rail service, including a high-speed linkage between Phoenix and Tucson and commuter service in the Phoenix metro area, have been discussed from time to time. The high-speed line would require billions of dollars for service to a currently unknown and untested market. A commuter network in the Phoenix metro area might attract more riders, and examples of the development of such services in Albuquerque/Santa Fe and Salt Lake City are encouraging. In those places, however, builders were able to buy unused track from railroads; in Phoenix any passenger service would have to share tracks with freight trains, and those tracks are already at or near capacity.

Freight Rail

According to ADOT, the number of freight trains crossing Arizona is expected to grow by 15 to 20 percent by 2010. The problems associated with grade-level crossings will likewise get worse.

Funding

The Vision 21 Task Force projected a total of $61.3 billion as necessary to fund all major modes of transportation for the period 2000 through 2020, but then estimated the available revenues from all sources for the same period to be $41 billion, amounting to a shortfall of over $20 billion for this two-decade period. Since roadways demand by far the largest expenditures of all transportation systems, the Vision 21 Task Force projected that they will suffer most from this shortfall. Another study, by the ADOT Transportation

Planning Division, concluded there is a $1.75 billion 20-year backlog to bring rural highways in Arizona up to a "minimally acceptable" standard, and a $728 million backlog to bring urban highways up to this same standard. The *SANS 2000* study concluded that $315 million in additional funding is needed by 2010 to maintain current levels of service at Arizona's 20 commercial service and reliever airports, and that another $649 million in new funding would be needed to bring these airports up to minimally acceptable standards.

The recommendations of the Vision 21 Task Force to make up the shortfall in Arizona's transportation funding are, first of all, to increase the state's gasoline tax. This tax, fixed by law at 18 cents per gallon, is a flat tax, subject to the negative effects of inflation and fuel efficiency. Vision 21 recommended an immediate increase by five cents per gallon, to be followed by another four cents four years later (which, according to the Task Force's original timetable, would be 2006), to be followed by additional two-cent increases at five-year intervals. This would raise the per-gallon tax to a total of 31 cents, one cent lower than the tax currently imposed by Connecticut, and just slightly higher than New York. Because the gasoline tax feeds directly into the HURF, which is constitutionally restricted to roadways and bridges, the Task Force also recommended the development of statewide funding sources that could be used to meet the needs of other modes of transportation. The Task Force called for the phasing in of a dedicated, statewide transportation sales tax, adding up eventually to 0.75 percent, and a dedicated, statewide development impact fee equal to one percent of value, to be imposed on all new commercial and residential development in the state.

Regional Coordination

Another principal recommendation of the Vision 21 Task force, on an issue perhaps even more critical than funding, concerned the coordination of regional land-use planning with long-range transportation plans. This might seem obvious on its face, but the experience of growth in northern Pinal County, of the Anthem development north of Phoenix and of rapid growth in the west valley, all in the absence of the necessary transportation infrastructure, illustrate the extent of the problem. One entity, generally local, approves new development with an eye perhaps on increasing its tax base, leaving the transportation issues to other entities at the regional or state level. In this way as metropolitan growth in the Tucson area begins to bleed into southern Pinal County and eastward into Cochise County—Anthem is currently planning a new development in Benson—the experience of the Phoenix metro area is likely to be repeated, if on a smaller scale.

Chapter 4

WATER AND GROWTH

SUSANNA EDEN AND SHARON B. MEGDAL

The fates of ancient civilizations hint at the risks of growing beyond the natural limits of available water resources. We have seen the consequences of water scarcity in countries that lack economic and technological resources; and even in the United States, long-term drought has caused large-scale dislocations as seen, for example, in the Dust Bowl of the 1930s. The settlement of the western United States, however, has been a story of growth driving water development.[1] Historically, investments in reducing water uncertainty have yielded dividends in financial stability and economic growth. The water displays in Nevada's casinos and decorative lakes in Arizona's subdivisions are emblematic of the value of water in attracting growth. Increases in population, however, are leading to stresses on current supplies and competition for new supplies.

Another engine of growth for Arizona is the quality of life provided by its uniquely beautiful environment, in which water is a key ingredient. Yet there has been consistent tension between the water demands of growing populations and the needs of the environment. Use of surface and groundwater for growth of the population and the economy has resulted in significant loss of riparian areas and habitat. Repairing and maintaining Arizona's environmental heritage will be a major challenge as the state's population continues to grow. Recently, river restoration projects, such as those in Phoenix, Mesa and Yuma, have been undertaken to enhance the quality of life for urban residents and visitors. These projects involve major commitments of resources over extended periods of time. "The importance of these projects to the quality of ... life in the Sonoran Desert is made evident by significant actual and planned public investments" (Megdal, 2005, p. 1).

[1] Recent news from California suggests that the role of water in limiting growth may be a more important policy question in the future. The California Court of Appeals rejected a CALFED plan because its environmental review was based on the notion that growth in California is inevitable and therefore required increased water delivery from north to south. The Court said CALFED "appears not to have considered ... smaller water exports from the Bay-Delta region which might, in turn, *lead to smaller population growth due to the unavailability of water* to support such growth" (Pitzer, p.3, emphasis added).

GROWTH AND WATER DEMAND TRENDS

In the 25 years since 1980, Arizona's population has more than doubled from 2.7 million to 6.0 million. Between 1990 and 2004, the highest rates of growth in the state were experienced in Mohave, Yavapai, Pinal and Yuma Counties, while the greatest growth in absolute numbers has been in Maricopa County (with a gain of more than one million people since 1990), Pima, Pinal and Mohave Counties. Population projections as detailed in Chapter 2 indicate continued high growth rates in these same areas. The needs of the major population centers in Maricopa and Pima Counties are widely known. Although the numbers are smaller, communities in other counties are facing similar challenges. Yavapai County must supply its rapidly growing population and preserve the unique environmental qualities supported by perennial flows in the upper Verde River. Coconino County, with only a slightly lower growth rate, has experienced water supply difficulties when drought conditions have reduced normal supplies. Despite aggressive conservation and water rights acquisition measures taken by Flagstaff, the city continues to face potential shortfalls. Table 4.1 shows the total freshwater withdrawals in selected fast-growing counties in Arizona.

TABLE 4.1
FRESHWATER WITHDRAWALS IN SELECTED FAST GROWING COUNTIES, 1985–2000
(thousand acre-feet)

	1985	1990	1995	2000
Maricopa	2,790	2,800	2,680	2,410
Mohave	114	163	157	172
Pima	260	256	296	337
Pinal	1,100	850	1,410	1,180
Yavapai	78	215	95	92
Yuma	1,480	1,410	1,570	1,640

Source: U.S. Geological Survey, *Water-Use Trends in the Desert Southwest—1950–2000*, 2004.

Increases in urban and suburban populations will increase municipal water demand. Water use increases proportionally with population growth if per capita use remains steady. Many factors affect per capita usage. For example, new construction to accommodate growth can include water-saving features that reduce per capita consumption. On the other hand, large cities can alter their own climates through the creation of urban heat islands, which in turn may lead to higher water use. Of greater importance to water demand are the water-use habits and expectations of residents. Conservation programs have met with mixed results in the past, and the realistic potential for savings is a subject of debate.

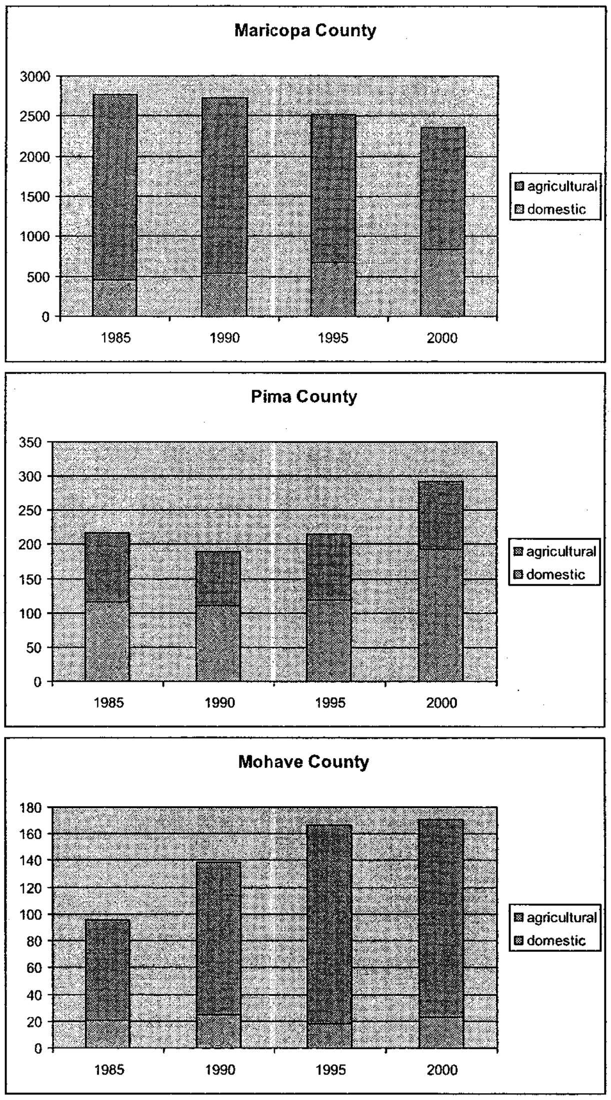
It often is assumed that population growth will occur on previously irrigated farmlands, and when this happens, total water use will decline. But this has not always been the case. In some places, residential development takes place on desert land, or farmland is merely displaced by development to new agricultural parcels further from cities, and total water use increases. In Maricopa County, total water usage declined between 1990 and 2000, when a 56 percent increase in public supply was more than offset by a 30 percent decrease in agricultural irrigation. On the other hand, no long-term change in water use was recorded when Salt River Project agricultural acreage was converted to residential and commercial development. Figure 4.1 compares changes in agricultural and domestic water use in Maricopa, Pima and Mohave Counties from 1985 to 2000.

CURRENT WATER SOURCES

Currently, Arizona draws on four principal sources of water: the Colorado River, other surface water, groundwater and effluent. An average of 39 percent of Arizona's water (2.8 million acre-feet) comes from the Colorado River, and about half of that is delivered through the Central Arizona Project (CAP) to central Arizona. Non-Colorado River surface water sources include the Salt, Verde, Gila and Agua Fria Rivers and the reservoir storage systems located on them. On average, Arizonans get 19 percent of their water (1.4 million acre-feet) from all non-Colorado River surface water sources (Figure 4.2).

Approximately 40 percent of the water used in Arizona comes from groundwater. In total, Arizona's aquifers hold a very large amount of water, most of it water that has been collecting underground for thousands of years. However, the capability to extract and use this groundwater is limited by a number of factors, including depth, geology and chemistry. Natural recharge, which occurs mainly along mountain fronts and in stream channels, continues to add to this supply. In the most populous areas of the state as well as in

FIGURE 4.1
FRESHWATER USE
(thousand acre-feet)

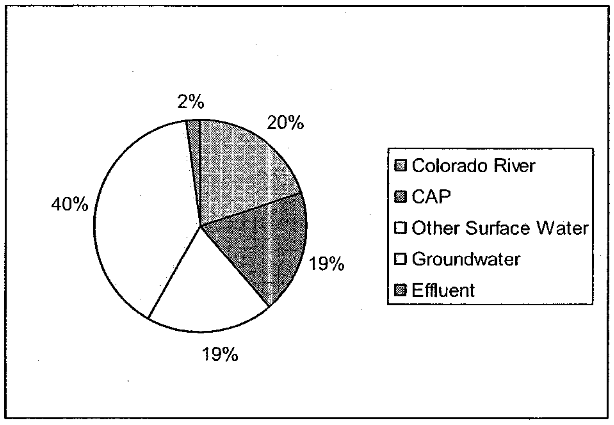


Source: U.S. Geological Survey, *Water-Use Trends in the Desert Southwest—1950-2000*, 2004.

areas with irrigated agriculture, however, water is pumped from groundwater sources faster than it is replenished naturally. This has led to declines in water level by hundreds of feet in some areas as well as aquifer compaction, subsidence of the ground surface and soil fissures.

FIGURE 4.2

WATER SOURCES, 2004



Source: Kathy Jacobs and Marshall A. Worden, "Water in Arizona: Challenges Met and Remaining," Chapter 1 in *Arizona's Water Future: Challenges and Opportunities*, Phoenix: Arizona Town Hall, 2005.

Effluent is treated wastewater. The larger the population, the more effluent is generated. Only a small portion of the effluent that is generated in Arizona is used: approximately 0.14 million acre-feet per year. Effluent in Arizona is used most often for irrigating non-food crops and turf and for industrial cooling. When released to stream beds, it may support riparian ecosystems. In conjunction with stream releases or in separately constructed facilities, it also is used for artificial recharge of aquifers. Combined, these effluent uses represent only two percent of Arizona's water demand.

WATER RESOURCE MANAGEMENT IN ARIZONA

In Arizona, the different sources of water are managed through different systems and under different agencies. Groundwater in populous parts of the state is managed differently from that in less populous areas. In addition, water quality is managed separately from water supply.

Water from the Colorado River is subject to the Law of the River, a collection of interstate compacts, international treaties, Congressional acts and Supreme Court Decrees resulting from lawsuits between the states sharing the river. The U.S. Bureau of Reclamation is responsible for managing the river, under the decision-making authority of the Secretary of the Interior. The Arizona Department of Water Resources (ADWR) is responsible for making recommendations to the Secretary regarding allocation of Arizona's share of the river, although essentially all of the allocations already have been made.

The CAP is allocated approximately half of Arizona's Colorado River water. Construction on the CAP canal, which carries Colorado River water to users in central Arizona, began in 1973. The first deliveries were made on the incomplete system in 1984, and the project was declared substantially complete in 1993. The canal system has a designed capacity of 1.8 million acre-feet per year, and a total entitlement to 1.5 million acre-feet. The CAP is managed and operated by the Central Arizona Water Conservation District (CAWCD), an organization formed to contract with the federal government for CAP water and subcontract with water users in central Arizona. The CAWCD implements policies set by its Board of Directors, a 15-member body elected from the CAP's three-county service area: Maricopa, Pima and Pinal Counties. The Board sets CAP rates annually.

The Salt River Project (SRP) manages surface water from its reservoirs on the Salt and Verde Rivers. It is a quasi-governmental organization created to gain federal assistance in building one of the first major water development projects in the West. The Bureau of Reclamation, which constructed the reservoirs, retains title to them. Dams and reservoirs have been added to the system as needs expanded, and the organization has evolved to manage and operate the extensive SRP water and power systems. Land owners in the SRP service area own rights to SRP water. Although the SPP was originally developed for agriculture, about 88 percent of its member lands are now residential. The project allocates water to member lands at a standard annual rate of three acre-feet per acre, except in times of shortage, such as in 2004, when two acre-feet per acre were allocated.

A body of law referred to as "prior appropriation" governs other surface water. The right to use a certain amount of surface water for a specified purpose is acquired through the process of obtaining a permit to take the water, constructing the means for taking the water and conveying it to its point of use, and then using the water. The first person to acquire a right to water from any water body has the highest right to water, while the newest water right holder has the lowest right. In times of shortage, the holders of the older rights receive all of their water before newer rights holders receive theirs.

Most of the surface water in Arizona already has been appropriated. ADWR administers the surface water permit program, but the rights holders perform water management, and disputes between rights holders that are not settled between them are litigated.

Arizona law holds that effluent belongs to the entity that generates it (except under certain special circumstances). The entity has the right to recapture the effluent even if the effluent has been discharged to a stream channel for many years and others have appropriated the flow as surface water. ADWR has an interest in effluent as a renewable water resource, especially when it is substituted for groundwater use or recharged to the aquifer in Active Management Areas (AMAs). The uses of effluent are regulated for environmental and public health purposes by the Arizona Department of Environmental Quality (ADEQ) and the U.S. Environmental Protection Agency (EPA). These agencies also share regulatory authority over other activities relating to water quality such as waste discharges, nonpoint source pollution, groundwater remediation and drinking water treatment.

Groundwater is managed under two systems. In critical groundwater areas, *i.e.*, the AMAs, ADWR regulates the use of groundwater under the authority of the 1980 Groundwater Management Act (GMA). In the rest of the state, groundwater is governed by the reasonable use doctrine: the owner of land has the right to pump groundwater from beneath the land for a reasonable use on the land. Like surface water within the prior appropriations system, under reasonable use, groundwater management is the responsibility of the right holder and intractable disputes between rights holders are litigated. ADWR issues permits for water wells and maintains a registry of well permits.

More comprehensive groundwater management is possible in AMAs through the planning and regulatory activities of ADWR. Since the 1940s, groundwater has been pumped more rapidly in certain parts of the state than it has been replenished, resulting in a condition called "overdraft." AMAs were created in basins where groundwater overdraft had become a critical issue because of population growth and agricultural water uses. The management goals of the AMAs differ in some ways because of their different situations, but they share the overall goal of reducing or halting overdraft.

Four AMAs were created at the time of the GMA passage: Phoenix, Tucson, Pinal and Prescott. The Santa Cruz AMA, which split off of the Tucson AMA, became a separate AMA in 1994. The boundaries of the AMAs surround major population centers and generally coincide with the boundaries of groundwater basins (Figure 4.3). Eighty percent of Arizona's population lives within the boundaries of these AMAs. Through the mechanisms established in the GMA, ADWR can manage groundwater withdrawal and use to achieve AMA-wide goals. Table 4.2 shows the management goals for each of the AMAs. The GMA also established Irrigation Non-Expansion Areas, where irrigated acreage could not expand.

TABLE 4.2
ACTIVE MANAGEMENT AREA GOALS

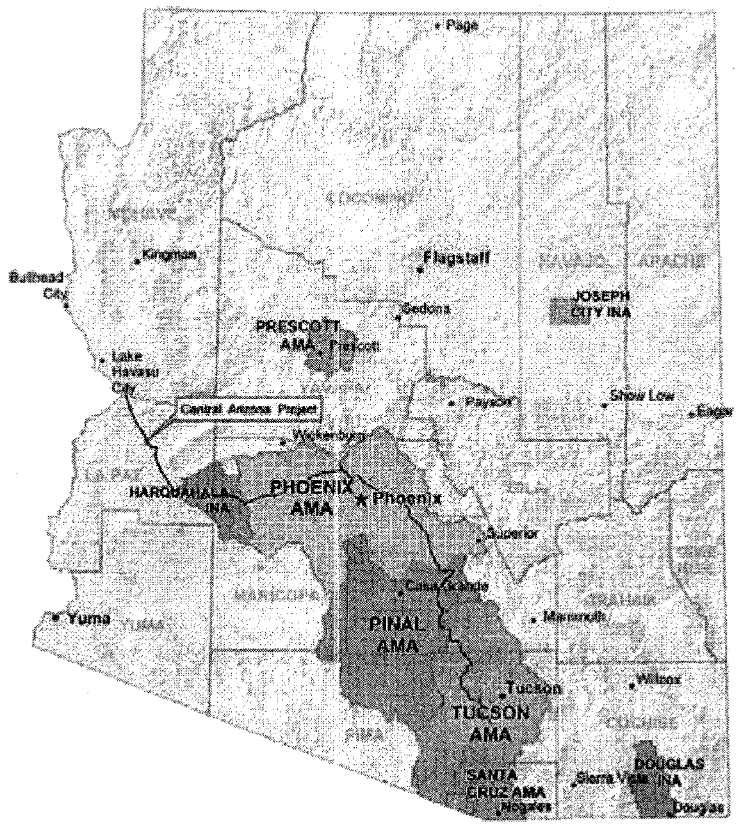
AMA	Description	Goals
Phoenix AMA	Large, urban area; agricultural use	Safe-yield by 2025
Pinal AMA	Agricultural use; small urban area economy	Extend agricultural economy as long as feasible. Allow development of non-irrigation water uses. Preserve water supplies for non-agricultural uses.
Prescott AMA	Large, urban area	Safe-yield by 2025
Santa Cruz AMA	Small urban area; binational; riparian and water level issues	Maintain safe-yield. Prevent local water tables from declining long-term.
Tucson AMA	Large, urban area	Safe-yield by 2025

Note: Safe-yield is defined as a long-term balance between the annual amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge.
Source: Arizona Department of Water Resources, 2002.

No new areas of Arizona have become AMAs since the passage of the Act. The GMA provides for designation of AMAs where overdraft is identified as a critical problem, and ADWR undertook studies to determine the need in the San Pedro watershed of Cochise County. The ADWR opinion, issued in March 2005, stated that the area did not meet statutory requirements for an AMA. This opinion disappointed environmental interests, but reflected the preferences of most jurisdictions in rapidly growing areas outside AMAs. They continue to prefer local action to formation of an AMA and the state-level regulation that would ensue.

Within AMAs, annual groundwater withdrawals are limited and subject to regulation according to the type of right held by the pumper. There are irrigation rights, non-irrigation rights (Type I and Type II), service-area rights and rights pursuant to new groundwater withdrawal permits. Domestic wells with low pump capacities (generally, 35 gallons per minute or less) are exempt from most GMA regulations.

FIGURE 4.3
ACTIVE MANAGEMENT AREAS AND IRRIGATION NON-EXPANSION AREAS



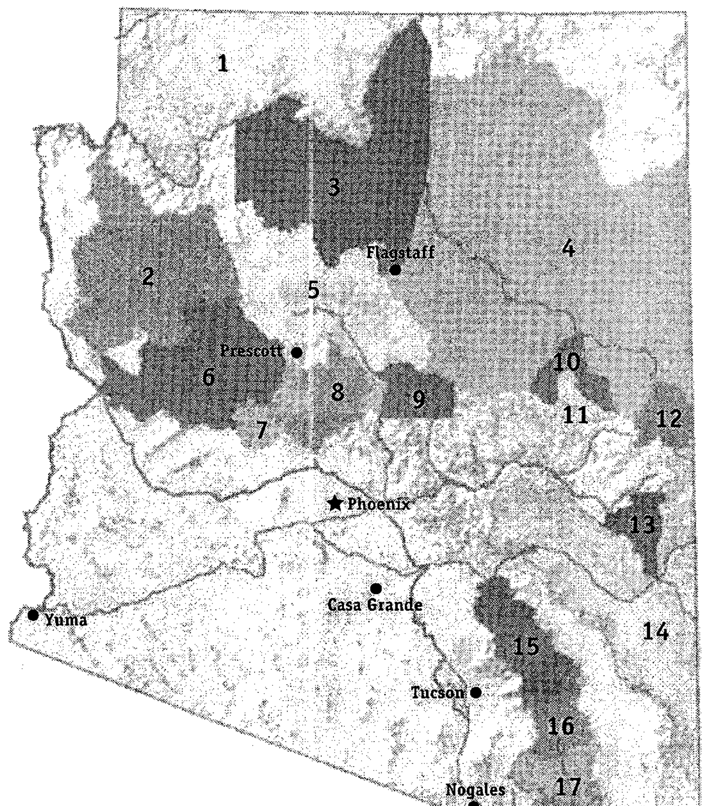
Assured Water Supply and Adequate Supply Rules

Developers of new subdivisions are required to show that they have access to sufficient water to support the needs of the development. Outside of AMAs, developers must obtain a determination of water supply adequacy from ADWR before they can subdivide land and sell lots. However, even when the water supply is determined to be inadequate, lot sales may proceed as long as the first purchaser of the land is informed.

A few new tools exist for counties and communities outside AMAs to help them prepare for growth. The Arizona Legislature has required and authorized rural communities to plan for growth and drought. "Growing Smarter" legislation passed in 2000 contains a requirement that growing municipalities with populations larger than 2,500 and counties with more than 125,000 people include a water resources element in their comprehensive plans. The element must identify legally and physically available supplies that are known to exist, estimate future demand for water, and describe how the demand will be served. The requirement provided an incentive for the counties and municipalities to plan for growth and include water supplies among the elements included in the plans. The Arizona Rural Watershed Initiative has provided planning and technical assistance to rural areas. Authorizing legislation gave impetus to the creation of watershed partnerships and such alliances have been formed in 17 watersheds (Figure 4.4). Active alliances have focused first on acquiring accurate information about their water situations and informing and educating themselves and their communities. Their combined efforts give them a stronger voice in regional and state decisions.

More effective water management tools are available within AMAs. There, developments either must obtain a Certificate of Assured Water Supply (AWS) from ADWR or must be served by a water provider with an ADWR-issued AWS Designation. In order to obtain a certificate or designation, the developer or provider must show that water is physically, continuously and legally available for 100 years and that it meets federal and state potable water quality standards. In addition, the water supplier must show the financial capability to develop any needed water infrastructure. Finally, use of the water must be consistent with the water management goals of the AMA. This final criterion means that a significant portion of the water used by new developments must come from renewable supplies. For the most part, the renewable water used to meet this requirement in central Arizona is CAP water, even for developments too far distant from the CAP canal to take the water directly. Where groundwater conditions are favorable, the rules allow the developer or provider to offset groundwater use by the new development with recharge of renewable water or substitutions of renewable water for an established groundwater use elsewhere in the AMA.

FIGURE 4.4
RURAL WATERSHED GROUPS



Arizona Watershed Alliance

1 Arizona Strip
2 Northwest Arizona Watershed Council
3 Coconino Plateau Regional Water Study
4 Little Colorado Multi-Objective Management
5 Upper Verde and Middle Verde Studies
6 Upper Bill Williams
7 Upper Hassayampa
8 Upper Agua Fría
9 Northern Gila County Water Plan Alliance
10 Silver Creek
11 Show Low Creek
12 Upper Little Colorado River Partnership
13 Eagle Creek
14 Upper Gila
15 Lower San Pedro
16 Middle San Pedro
17 Upper San Pedro Partnership

Source: Arizona Department of Water Resources.

In the process of developing the AWS rules, it became clear that a mechanism was needed to give developments on AMA land distant from the CAP canal access to renewable supply credits for development. At the same time, Arizona was not using its full entitlement to CAP water. The large quantity of "excess" CAP water represented a financial challenge and a water management opportunity. The State legislature authorized development of a Groundwater Recharge Program and creation of the Central Arizona Groundwater Replenishment District (CAGRD) and Arizona Water Banking Authority (AWBA). These actions all were intended, among other goals, to use water available immediately that otherwise would go unused in Arizona. They also provide ways to buffer CAP users from system shortages and outages. In addition, the recharge program and the CAGRD help developers meet AWS requirements.

The Recharge Program

Arizona's groundwater recharge program allows groundwater users to accrue credits that can be used to claim water in the future or to offset current groundwater pumping. Entities with CAP subcontracts can store CAP water they cannot use immediately in recharge facilities, from which they may recover the water later. They may also recover the water at a different location. In Groundwater Saving Facilities, water credits are accrued for substituting CAP water for groundwater pumped pursuant to an irrigation, or other, grandfathered right. Water credits also can be earned by recharging effluent. Long-term groundwater storage credits are banked in the account of the storage permit holder. Later recovery of storage credits requires a recovery well permit. Many issues related to recovery of long-term storage credits remain to be resolved, and they are likely to have an impact on how future water supply plans are configured. Table 4.3 shows the number of permitted recharge projects in AMAs as of June 30, 2005.

Subdivision developers and municipal providers also can comply with AWS requirements by joining the CAGRD. CAGRD members pay the District, which assumes the obligation to replenish excess groundwater use, as determined by implementation of the AWS Rules. This option is especially useful for entities that do not hold CAP subcontracts. Because of factors such as the high cost of infrastructure, a few providers with CAP subcontracts and the new developments in their service areas have chosen to use the CAGRD by requesting that their subcontract entitlements be assigned to that organization. The AWS program and the CAGRD function together to ensure that all new subdivisions in AMAs include a substantial proportion of renewable supplies in their water portfolios. The CAGRD, in its most recent ten-year plan of operation, projects enormous growth in demand for its replenishment services over the next 25 years. Figure 4.5 projects CAGRD's replenishment obligations both for current members only and for new enrollments. The integrity of the system rests on its ability to meet its future replenishment obligations. In its most recent ten-year plan, the CAGRD projected declining availability of excess CAP water to the point that the District will not be able to meet its replenishment obligation with excess CAP water by 2020 and possibly as early as 2015. Other sources will have to be used.

TABLE 4.3
PERMITTED RECHARGE PROJECTS IN AMAS
(June 30, 2005)

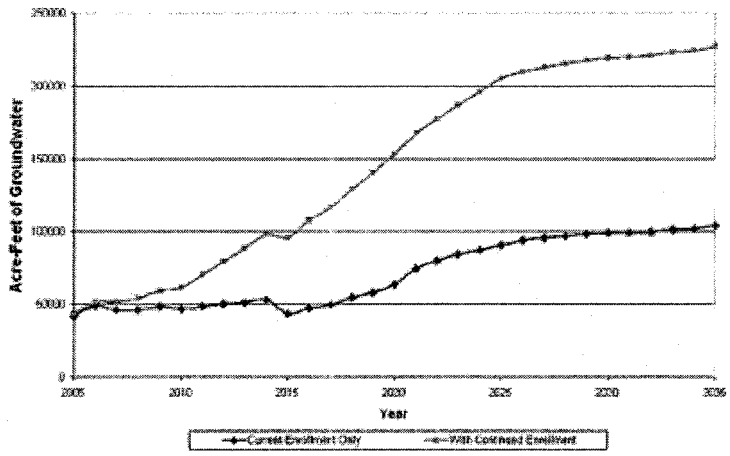
	CAP	Effluent	CAP + Effluent	CAP + Surface Water	Surface Water + Effluent	CAP + Effluent + SW	All
Phoenix AMA							
USF	13	21	3	2		2	41
GSF	5	3	1				9
Prescott AMA							
USF		3			1		4
GSF							0
Pinal AMA							
USF		4					4
GSF	3						3
Tucson AMA							
USF	4	5					9
GSF	6						6
Total AMAs	**31**	**36**	**4**	**3**	**1**	**1**	**76**

Note: USF = Underground Storage Facility and GSF = Groundwater Savings Facility.
Source: Arizona Department of Water Resources, Semi-Annual Status Report, June 30, 2005

Arizona Water Banking Authority

The AWBA was created in 1996 primarily to ensure reliable municipal water deliveries during future shortages on the Colorado River or CAP system failures. It achieves this by storing CAP water in constructed recharge and groundwater savings facilities. The AWBA does not compete with other CAP water users or rechargers, standing last in line in priority. It has, however, used all the unclaimed and unused CAP water in the system. Since its inception, the AWBA has stored or saved more than two million acre-feet of water for Arizona uses. The AWBA also stores some water for Nevada under its interstate banking authority. The AWBA works closely with the CAWCD, which has the responsibility to deliver recovered CAP water in times of shortage or outage of the CAP canal.

FIGURE 4.5
PROJECTED CAGRD REPLENISHMENT OBLIGATIONS



Source: Justin Ferris, Sharon B. Megdal and Susanna Eden, "An Introduction to the Central Arizona Groundwater Replenishment District," The University of Arizona, Water Resources Research Center, 2006.

TOOLS AND STRATEGIES

To accommodate new growth, planners are examining their water portfolios and looking for ways to expand them. Three main avenues for expansion have been identified.

Demand Management and Conservation

By using less, Arizonans create a source of water to support growth. This is not a universally popular idea, and generally will not lead to conserving behaviors. But metering and prices can motivate conservation behavior that saves consumers money on their water bills. Incentive and assistance programs can lead to changes in infrastructure that make it more water-efficient. Regulation and ordinances can mandate or prohibit activities in order to reduce water use.

Maximize Use from Existing Sources

Most water plans include maximizing the use of existing renewable sources of water: CAP subcontracts, other surface water rights and effluent, along with continued use of groundwater. As these sources approach full utilization, problems become more apparent and costs rise. Although southern Arizona is rich in groundwater resources, problems associated with overpumping are already severe in some areas. Groundwater overdraft is drawing down water tables, threatening or destroying ecosystems, and, in some places, causing subsidence. In the headwaters of the Verde, Agua Fria and San Pedro Rivers, groundwater pumping will have to be limited if surface water flows are to be maintained. Even in the best of circumstances, the costs of extracting groundwater rise as depth to water increases, and in Arizona the quality of the water usually worsens with depth.

There will be "excess" CAP water for some years into the future, although the annual amount of this "excess" is projected to decline from 900,000 acre-feet in the year 2005 to just over 100,000 acre-feet in 2049, and to zero in 2050. In addition, some CAP water will be available for redistribution over the next 20 years, although uncertainty occasioned by on-going stream adjudications and Indian water settlements makes it impossible for any entity to plan on acquiring more CAP water from this source. Other Colorado River water that is not allocated to the CAP could be leased or acquired by other mechanisms from Indian and non-Indian irrigation water users with rights to pump directly from the river. However, such transfers would be complicated and would require that third-party impacts be addressed.

Develop New Sources

At this time, the outlook for new water is limited. Importation of groundwater from rural areas of Arizona to urban areas is limited by statute. Only the Butler, McMullen and Harquahala Valleys may be exploited for groundwater export to AMAs. It has been estimated that large quantities of water exist in these basins, but acquiring and transporting the water would be extremely expensive. In addition, weather modification and treatment of poor quality water, *e.g.*, desalination, have been mentioned as future ways to increase water supplies, assuming the technologies are cost-effective.

STRATEGIES FOR ASSURING WATER FOR CURRENT AND FUTURE POPULATIONS

Water planning in Arizona has served to accommodate growth, not restrict it. It has been recognized by growth proponents and opponents alike that the more efficiently water resources are managed, the more growth water supplies will support. With current technology, Arizona has enough water to support a population several times its current size, assuming that essentially all the water would go to municipal and industrial users. However, as more than one observer has commented, other environmental stresses and economic dislocations will be felt long before growth reaches the theoretical limits of Arizona's water supply. Finding a smooth path to sustainable water supply is another matter.

Demand Management Strategies

Improvements in treatment and delivery systems, including leak detection and repair are capable of saving large quantities of water. Metering reduces demand by providing consumers with water use information that allows them to monitor and manage their own water use. Other mechanisms that provide users information for the purpose of inducing water conserving behavior include education and assistance programs. These programs have included information, for example, about low-flow plumbing fixtures, low-water-use landscaping, irrigation scheduling and irrigation system maintenance. Water rates also have been used to induce water saving behavior; tiered water rates, which are relatively low for smaller amounts and rise in steps as the amount of water use increases, tend to discourage the use of very large amounts of water, especially for outdoor uses.

Inducing consumers to make costly structural changes like low-water-use plumbing and landscaping may be more effectively achieved through incentives, and some incentive programs have been very successful. One strategy reduces water service hook-up fees in exchange for incorporating water saving into house and landscape designs. Another tool is modification of building practices through changes to building codes. Local ordinances cause reduced water demand by restricting uses temporarily in time of drought or other supply emergencies. Temporary restrictions may limit hours for certain types of use, such as outdoor car washing, or prohibit them outright. More permanent reductions have been achieved by ordinances that limit the amount of high-water-use landscaping in new developments.

Land Use Planning

Land use planning has been used as a growth-management tool to create and preserve amenities valued by the community such as residential character, open space, transportation and historical and cultural values. On the other hand, water planning has been used most often to prepare for and accommodate growth. Some people have suggested, however, that water planning can provide a powerful tool for managing growth. There are communities in the United States where a moratorium on new water hookups has been used to slow and redirect building activity to prevent growth from outstripping the ability of a city or county to supply water. Some private water companies in Arizona have had to impose moratoria within their service areas. The AWS rules for new subdivisions have the potential for regulating growth on the basis of the availability of water within AMAs. The CAGRD has buffered developers from the growth management potential of those rules.

Water Resource Impact and Development Fees

Impact or development fees are common tools used by local jurisdictions to offset the costs imposed by population growth, such as those for transportation and education. Water impact fees do not necessarily reduce water demand, but they provide a source of funds to pay for new supplies to meet new demands. Proponents of such fees argue that the price of new development should reflect the additional costs it imposes on a jurisdiction. Opponents argue, among other things, that development ultimately benefits the entire community, so the whole community should pay.

STRATEGIES FOR AUGMENTING SUPPLIES

Reusing Effluent

Currently more effluent is generated than is reclaimed for direct use or recharged. Effluent is the only source of water that is growing. Growth in effluent follows simply from the fact that more people are washing dishes, taking showers and flushing toilets. Wastewater can be reused through several mechanisms. At the site of use, "graywater"–drain water from washers, tubs, showers and other than kitchen sinks—can be used for landscape watering. Water quality guidelines for graywater use have been established by ADEQ. On-site use of graywater reduces demand for water from the potable water system. Although it currently provides an insignificant proportion of water saving to AMAs, its potential is much larger. However, widespread use of graywater could create sewage treatment system problems as a result of reduced flows in sewage lines. It also could affect the water supply plans of providers who are depending on increases in effluent flows based on historical practices, that is, almost no graywater use.

Wastewater, after it has been collected in a central facility, may be used for turf irrigation after tertiary treatment, or after purification it may qualify for some industrial or even for potable uses. Once considered a nuisance, effluent is becoming a valuable commodity. Treated wastewater that meets water quality standards established by ADEQ can be saved for later reuse through recharge. Most municipalities and many developers are planning to use most or all of the effluent they generate in the future. Frequently, water treatment facilities are included in development plans and effluent reuse is specified for golf course and landscaping irrigation. Decorative lakes constructed to enhance the desirability of new residential developments in Arizona were once filled with high quality water, but a law passed in 1987 ended the practice. Such lakes are now filled with treated effluent instead.

Throughout human history treated wastewater has been used in drinking supplies, and it continues to be used in cities that rely on surface water. Dilution in natural rivers removes the stigma of using treated wastewater directly. As population growth strains existing supplies, direct potable reuse of purified wastewater becomes an important resource option. A major impediment to this use is public disapproval and concern for health implications. With all the unregulated substances of concern moving from wastewater into the environment, water suppliers are looking seriously at the issue. Various entities have investigated recharge of effluent to take advantage of soil-aquifer treatment and blending with native groundwater for potable use. A project using effluent that has been purified by advanced treatment has been approved for a residential development in California.

Other Strategies

Weather modification is a strategy for enhancing the amount and timing of precipitation over watersheds. Feasibility studies have been carried out intermittently over several decades with mixed results. Most planners consider the near-term probability of producing more water through weather modification a long shot. Another technologically questionable strategy is desalination. The problems of high energy costs and disposal of brine streams have hindered large-scale desalination for municipal uses in the United States. It can be cost-effective in some situations, and Phoenix, for example, is investigating the possibility of treating and using brackish water from shallow aquifers southwest of the city.

CAP to Sierra Vista

Residents of Sierra Vista are actively studying the possibility of extending the CAP canal to that city. A feasibility study performed by the Bureau of Reclamation estimated construction would cost $193 million. This estimate is based on a pipeline with enough capacity to carry approximately 30,000 acre-feet of water per year. The same study estimated that the Sierra Vista area would use 38,500 acre-feet annually by 2050. The preferred route would run east along Interstate 10 from the current terminus at Pima Mine Road, turn south at Arizona Highway 90, and end near Fort Huachuca's main gate. Sierra Vista currently has no CAP water subcontract. For Sierra Vista, getting the water may be a greater challenge even than paying for the conveyance. On the other hand, although the Green Valley Community Water Company, only seven miles south of the terminus, actually holds a CAP subcontract for 1,900 acre-feet of water per year, the high cost associated with extending the CAP canal has prevented that area from taking its entitlement.

Water harvesting and watershed management are strategies for capturing more of the water that falls as rain or snow for human use. Water harvesting in Arizona generally occurs on site and involves constructing and operating systems that collect, store and distribute precipitation, usually for landscape irrigation. The potential for water harvesting is large, but at the individual lot scale, its success depends on the knowledge and commitment of individual land owners. Watershed management involves manipulating plant cover on watersheds to enhance the amount and timing of runoff. Most commonly, management to increase water yields involves removal of phreatophytes, *i.e.* plants that use a lot of water and thinning of vegetation in general. Watershed management to increase water yields must include an understanding of the implications for water quality, soil stability and unintended environmental consequences.

TRANSFERRING, TRANSPORTING AND IMPORTING WATER

Inter-Sectoral Transfers—the Future of Agriculture

A substantial portion of the water for Arizona's growing population will come from reductions in agricultural irrigation. Currently, agriculture accounts for 80 percent of all water use in Arizona, down from 97 percent in 1950. For the most part, the conversion of agricultural water use to municipal use occurs on or near the farm. A prime example is conversion of SRP member lands from farms to residences. In 1980, the GMA anticipated the gradual decline of agricultural water use inside AMAs as farmland was replaced by municipal development. For various reasons, however, the overall anticipated decline in agricultural water use has not occurred. Table 4.4 juxtaposes data on irrigated cropland acreage with freshwater withdrawals for agriculture between the years 1990 and 2002.

TABLE 4.4
IRRIGATED CROPLAND AND FRESHWATER WITHDRAWALS FOR AGRICULTURE, 1990–2002

Year	1990	1992	1995	1997	2000	2002
Acres of irrigated cropland (thousands of acres)		903.2		1,016.6		887.1
Freshwater withdrawals (thousands of acre-feet)	6,060		6,390		6,050	

Sources: U.S. Department of Agriculture, Economic Research Service, State Fact Sheets: Arizona, December 8, 2005; and U.S. Geological Survey, Water-Use Trends in the Desert Southwest—1950–2000.

Renewable surface supplies provided about 49 percent of agricultural water use in the year 2000. Cities are eyeing these large quantities of renewable water as they look for new sources to meet their growing demand. Non-Indian irrigation water users on the Colorado mainstem include the Yuma County Water Users Association, Yuma Mesa Auxiliary Unit B, North Gila Valley Unit, Wellton-Mohawk Irrigation and Drainage District (IDD), Yuma Mesa IDD and Cibola Valley IDD. A number of different voluntary mechanisms could be used by cities to acquire water supplies from non-Indian irrigators. These include land purchase, temporary and long-term lease arrangement, forbearance,[2] fallowing and other conservation arrangements. Any agreements for acquiring agricultural water will require compliance with applicable state and federal policies.

Groundwater aquifers outside AMAs hold large quantities of water that might supply growing cities. Under current statutes, however, the num-

[2] Forbearance means that in any one year agricultural parties with rights to use Colorado River water would not take the water to which they are entitled so that others can use it. The right holders are compensated for forgoing their right to a certain amount of water.

4

Griffith CEC

REC'D MEYER, HENDRICKS, BIVENS & MOYES

DEC 2 1 1998

Arizona Corporation Commission
DOCKETED
DEC 1 6 1998

DOCKETED BY

BEFORE THE ARIZONA POWER PLANT AND TRANSMISSION LINE SITING COMMITTEE

In the matter of the Application of Griffith Energy LLC in conformance with the requirements of Arizona Revised Statutes 40-360.03 and 40-360.06 for a Certificate of Environmental Compatibility authorizing construction of a natural gas-fired, combined cycle generating facility in Mohave County, Arizona, southwest of Kingman, Arizona, a distance of about 9 miles.	CASE NO. 90 DOCKET NO. L-00000H-98-0090 DECISION NO. 61295

CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY

Pursuant to notice given as provided by law, the Arizona Power Plant and Transmission Line Siting Committee (the "Committee") held a public hearing in the Mohave County Board of Supervisors Facilities, 809 E. Beale Street, Kingman, Arizona, on September 14, 1998, in conformance with the requirements of Arizona Revised Statutes § 40-360, *et seq.*, for the purpose of receiving evidence and deliberating on the Application of Griffith Energy LLC ("Griffith") for a Certificate of Environmental Compatibility in the above-captioned case.

The following members and designees of members of the Committee were present for the deliberations and vote on the Application at the September 14, 1998, hearing:

Charles S. Pierson	Chairman, Designee for Arizona Attorney General Grant Woods
Steve Olea	Arizona Corporation Commission
Dennis Sundie	Arizona Department of Water Resources
Doug Sawyer	Arizona Department of Environmental Quality
Jeff Maguire	Appointed Member
Arlo Lee	Appointed Member

The Applicant was represented by Jay Moyes of Meyer, Hendricks, Bivens & Moyes, P.A., Attorneys for Griffith. There was one intervenor, Robert K. Holsinger. Sixty letters of support for the Project and two letters opposing the Project were received and have been placed in the docket.

At the conclusion of the hearing, the Committee, having received the Application, the appearance of Griffith, the evidence, testimony and exhibits presented by Griffith, and the testimony and evidence presented by the intervenor, and being advised of the legal requirements of Arizona Revised Statutes § § 40-360 to 40-360.13, upon motion duly made and seconded, voted unanimously to grant Griffith the following Certificate of Environmental Compatibility (Case No. 90):

Griffith Energy LLC is hereby granted a Certificate of Environmental Compatibility authorizing construction of a baseload 520 megawatt (MW) [650 MW peaking] natural gas-fired, combined cycle generating facility, together with the necessary and related infrastructure and appurtenances, such as roadways, gas and water pipelines, storage tanks, transmission interconnection switchyard, storm water and wastewater management facilities, warehouses and other buildings, which generating facility shall be located in the SW¼ of Section 6, T. 19 N., R. 17 W., in Mohave County, Arizona.

This Certificate is granted upon the following conditions:

1. The Applicant will comply with all existing applicable air and water pollution control standards and regulations, and with all existing applicable ordinances, master plans and regulations of the State of Arizona, the County of Mohave, the United States, and any other governmental entities having jurisdiction.

2. The source of water for operation of the Project shall be a new well field to be located in only that portion of the Sacramento Valley Basin lying south of the Kingman - Oatman Road and West of Interstate 40. Any alternative long-term supply of groundwater for the Project pumped from any different location must be pre-approved by the Arizona Corporation Commission.

3. Prior to construction of the Project, the proposed well field aquifer shall be tested by means of a new well to be drilled and pump tested, using a methodology proposed by Applicant's hydro-geologic consultant and approved by the Arizona Department of Water Resources ("ADWR") in accordance with generally accepted procedures, for a duration of at least 72 hours. The test results shall be made available, within a reasonable

time, to ADWR and Mohave County as a matter of public record.

4. During the operating life of the Project, the Project's water usage and the water table at the well field shall be metered and measured at six-month or shorter intervals and reported to ADWR annually; provided, however, that water table measurement may be reduced to annually, upon approval by ADWR, if the more frequent measurements reflect a consistent trend.

5. A procedure shall be established to annually monitor and report to ADWR any reasonably measurable land surface subsidence, using methodologies pre-approved in writing by ADWR in accordance with generally accepted procedures for measuring subsidence, for so long as the Project is using material quantities of groundwater.

6. This authorization to construct the Project will expire five (5) years from the date the Certificate is approved by the Arizona Corporation Commission unless construction is completed to the point that the plant is capable of operating at its rated capacity by that time; provided, however, that prior to such expiration the Project owner may request the Arizona Corporation Commission to extend this time limitation.

GRANTED this 13th day of November, 1998.

THE ARIZONA POWER PLANT AND
TRANSMISSION LINE SITING COMMITTEE

By ______________________
Charles S. Pierson, Chairman

DOCKET NO. L-00[illegible]0H-98-0090

APPROVED BY ORDER OF THE ARIZONA CORPORATION COMMISSION

Chairman	Commissioner	Commissioner

In Witness Hereof, I, Jack Rose, Executive Secretary of the Arizona Corporation Commission, set my hand and cause the official seal of this Commission to be affixed, this 16th day of Dec, 1998.

By Jack Rose
Jack Rose
Executive Secretary

Dissent: ______________________

ARIZONA DEPARTMENT OF WATER RESOURCES
Hydrology Division
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2448
Fax (602) 417-2425

RECEIVED
MOYES STOREY
MAY 11 1999

JANE DEE HULL
Governor

RITA P. PEARSON
Director

May 4, 1999

Arizona Power Plant and Transmission
Line Siting Committee
c/o Mr. Charles S. Pierson, Chairman
Office of the Attorney General
15 South 15th Avenue
Phoenix, Arizona 85001

Re: Griffith Energy Project, Certificate of Environmental Compatibility

Gentlemen:

The above-referenced Certificate contains conditions that involve approval by this Department ("ADWR") of certain actions required of the Applicant. This letter confirms fulfillment of and/or compliance with those conditions, insofar as ADWR is involved, as follows:

Condition 3:
A new production well has been drilled at the proposed well field site and pump tested using methodologies that were pre-approved by ADWR and in accordance with generally accepted procedures. The well drilling and testing results have been published in a detailed report entitled *Griffith Production Well 1, Results of the Drilling and Testing Program,* by Manera, Inc., dated March 20, 1999, which has been furnished to and reviewed by ADWR confirming compliance with the pre-approved methodologies and procedures.

Additionally, for your information with respect to Condition 2, ADWR has recently issued drilling permits for five additional production wells and one monitoring well that are proposed to constitute the well field and water supply for the Project, at locations complying with the designation in Condition 2 of the Certificate.

Respectfully,

Greg Wallace

Greg Wallace
Assistant Director

cc: Griffith Energy LLC
Jay I. Moyes

ARIZONA DEPARTMENT OF WATER RESOURCES
Hydrology Division
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2448
Fax (602) 417-2425

JANE DEE HULL
Governor

RITA P. PEARSON
Director

June 22, 1999

Arizona Power Plant and Transmission
Line Siting Committee
c/o Mr. Charles S. Pierson, Chairman
Office of the Attorney General
15 South 15th Avenue
Phoenix, AZ 85001

Re: Griffith Energy Project, Certificate of Environmental Compatibility

Gentlemen:

The above-referenced Certificate contains conditions that involve approval by this Department ("ADWR") of certain actions required of the Applicant. This letter confirms fulfillment of and/or compliance with those conditions, insofar as ADWR is involved, as follows:

Condition 5:
A procedure has been established to monitor for land surface subsidence. ADWR has received and hereby approves the surveyed location and placement of a permanent base reference monument, and the proposed procedure of monitoring surveys to be performed annually by an independent registered survey engineer to detect any movement of that monument after commencement of material groundwater pumping from the proposed well field.

Additionally, for your information with respect to Condition 2, ADWR has recently issued drilling permits for five additional production wells and one monitoring well that are proposed to constitute the well field and water supply for the Project, at locations complying with the designation in the Condition 2 of the Certificate.

Respectfully,

Greg Wallace

Greg Wallace
Assistant Director

GW/ef

cc: Griffith Energy LLC
Jay I. Moyes
Steve Olson
Dennis Sundie

2001

GRIFFITH ENERGY

Administrative Office:
3003 N. Central Avenue
Suite 1250
Phoenix, AZ 85012
602-604-2136
fax: 602-604-2188

Site Office:
3375 W. Navajo Drive
P.O. Box 3519
Kingman, AZ 86401
928-718-0102
fax: 928-718-0727

RECEIVED
MOYES STOREY
APR 29 2002

April 17, 2002

Arizona Department of Water Resources
Attn: Mr. Greg Wallace, Chief Hydrologist
500 North Third Street
Phoenix, AZ 85004

Subject: Griffith Energy Project Report in Compliance with Certificate of Environmental Compatibility Issued by the Arizona Corporation Commission

Gentlemen:

As required under conditions 4 and 5 of Griffith Energy LLC's Certificate of Environmental Compatibility, enclosed are the following: (1) Subsidence Monitoring Report; and (2) a graph depicting the real time readouts of 2001 changes in depth to water below ground level in the monitor well at the Mohave County Griffith Well field.

As the certified engineer's report states, there has been no subsidence of the benchmark monument since installed in November of 1998.

The aquifer water level at the well field monitoring well dropped from approximately 581.5 feet in March, 2001 to the 585.5 foot level in January 2002.

Finally, Peter Kaleta, P.E., Engineering Manager, Mohave County Water Division reports that the total Griffith Project water use for 2001 was just under 370 million gallons (369,667,000) or slightly over one million gallons per day, average.

If you have any questions, please call Chet Vasey at (928) 718-0102 ext. 227, or Jay Moyes at (602) 604-2106.

Sincerely,

Chet Vasey

Chet Vasey
Environmental Safety Manager
Griffith Energy Project

cc: Bill Alkema
[redacted]

MOHAVE ENGINEERING ASSOCIATES, INC.
- CONSULTING CIVIL ENGINEERS & LAND SURVEYORS -

Robert L. Schuetz, P.E.
Vice President / Engineering Mgr.

John A. Proffit, P.E.
President

Thomas R. Christopher, R.L.S.
Vice President / Surveying Manager

March 25, 2002

Mr. Chet Vasey,
Environmental Safety Manager
Griffith Energy, L.L.C.
P.O. Box 3519
Kingman, Arizona 86402

Dear Mr. Vasey,

I, Thomas R. Christopher, Land Surveyor in the State of Arizona, Registration No. 24514 hereby state the following:

That during the period ending March 15, 2002, Mohave Engineering Associates, Inc., under my direct supervision, completed a differential level run from the National Geodetic Survey Bench Mark designated as S 484, located in the Northwest quarter of Section 18, Township 19 North, Range 17 West to the Subsidence Benchmark set by Mohave Engineering Associates, Inc. in November, 1998, located in the Southeast quarter of the Southwest quarter of Section 10, Township 19 North, Range 18 West of the Gila and Salt River Meridian, Mohave County, Arizona.

The results of this differential level circuit indicate that there has been no subsidence or elevation change at the Subsidence Monument from the time the original level circuit was performed on November 20, 1998 and the current level circuit completed on March 15, 2002.

Respectfully,

Thomas R Christopher

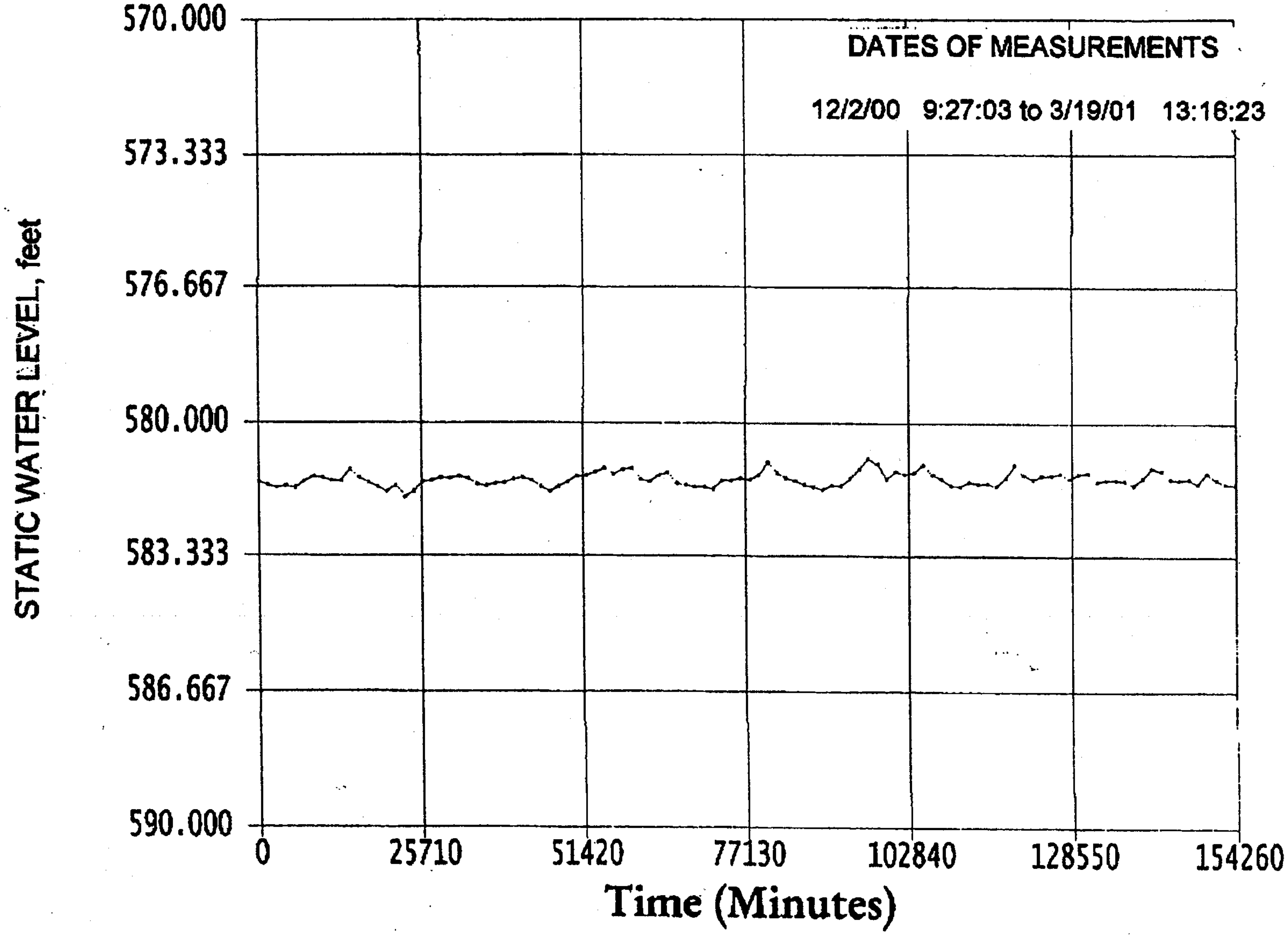
Thomas R. Christopher, R.L.S. 24514

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
24514
THOMAS R.
CHRISTOPHER
Date Signed 3/25/2002
ARIZONA U.S.A.

Thomas R Christopher

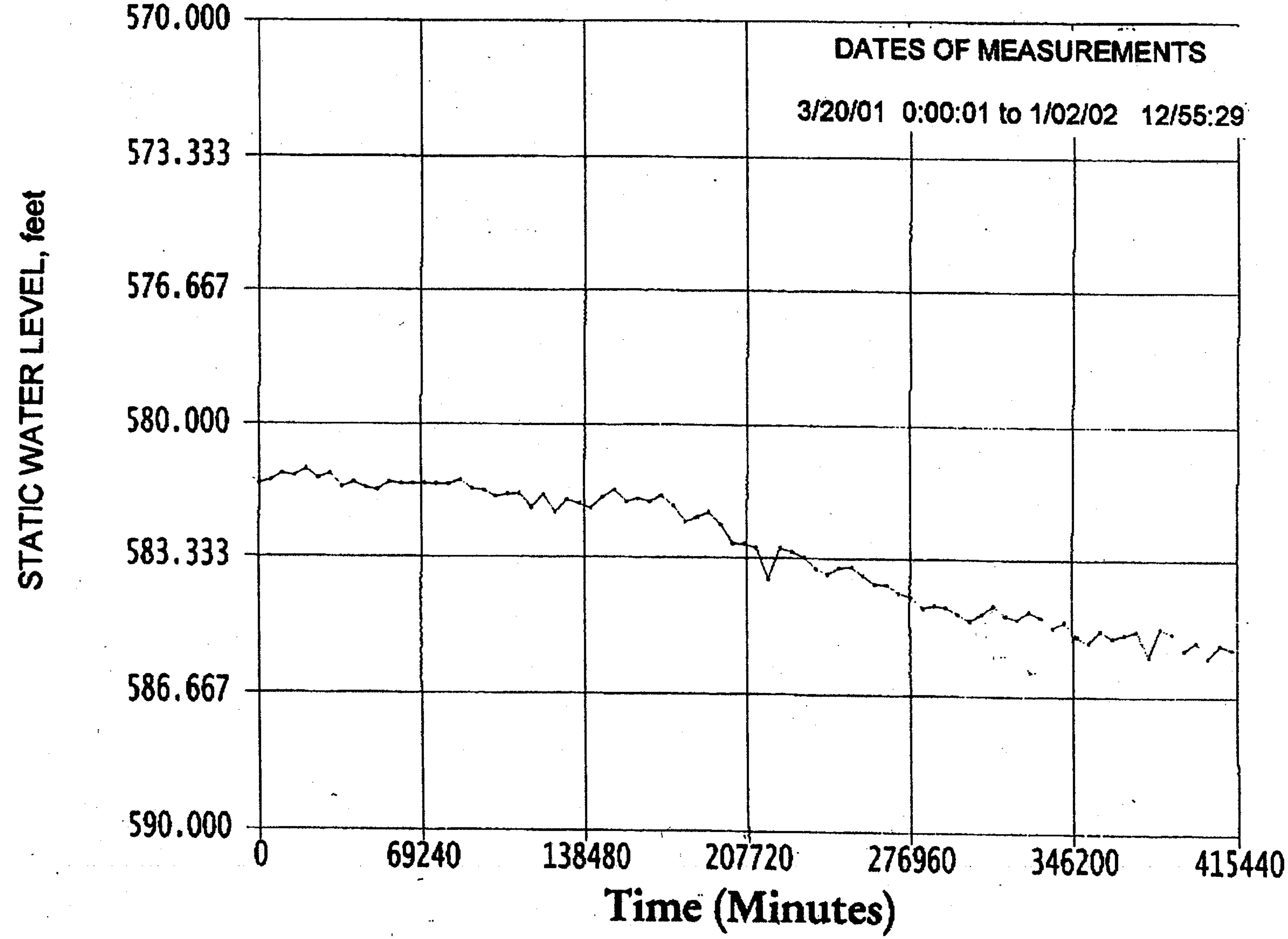
405 E. Beale St. • Kingman, AZ 86401 • Ph. 928-753-2627 • FAX 928-753-9118

Test #1



[1] - OnBoard Pressure

Griffith#1



[1] - OnBoard Pressure

2002

404-080-56

PRIMESOUTH
A SCANA COMPANY

PALMARK
A PRIMESOUTH COMPANY

P.O. Box 3519
Kingman, AZ 86402
(928) 718-0102
Fax (928) 718-0727

January 31, 2003

Arizona Department of Water Resources
Attn: Mr. Greg Wallace, Chief Hydrologist
500 North Third Street
Phoenix, AZ 85004

Subject: Griffith Energy Project Report in Compliance with Certificate of Environmental Compatibility Issued by the Arizona Corporation Commission

Gentlemen:

As required under conditions 4 and 5 of Griffith Energy LLC's Certificate of Environmental Compatibility, enclosed are the following: (1) Subsidence Monitoring Report; and (2) a graph depicting the real time readouts of 2002 changes in depth to water below ground level in monitor well no. 3 at the Mohave County Griffith Well field.

As the certified engineer's report states, there has been no subsidence of the benchmark monument since installed in November of 1998.

The aquifer water level at the well field monitoring well maintained from approximately 585.7 feet on January 2, 2002 to the 586 foot level on December 31, 2002.

Finally, Peter Kaleta, P.E., Engineering Manager, Mohave County Water Division reports that the total Griffith Project water use for 2002 was just under 523 million gallons for our first full year of operation (522,962,000).

If you have any questions, please call Chet Vasey at (928) 718-0102 ext. 227, or myself at ext. 222.

Sincerely,

Rex LaMew

Rex LaMew
Plant Manager
Griffith Energy Project

bcc: Jim Parker
Brenda Long
Darren Stephens
David S. Miller
Jay Moyes
~~File: 404-080-56~~

MOHAVE ENGINEERING ASSOCIATES, INC.

- CONSULTING CIVIL ENGINEERS & LAND SURVEYORS -

Robert L. Schuetz, P.E.
Vice President / Engineering Mgr.

John A. Proffit, P.E.
President

Thomas R. Christopher, R.L.S.
Vice President / Surveying Manager

RECEIVED
JAN 29 2003

January 23, 2003

Mr. Chet Vasey,
Environmental Safety Manager
Griffith Energy, L.L.C.
P.O. Box 3519
Kingman, Arizona 86402

Dear Mr. Vasey,

I, Craig T. Micek, Land Surveyor in the State of Arizona, Registration No. 31600 hereby state the following:

That during the period from January 15 to January 20, 2003, Mohave Engineering Associates, Inc., under my direct supervision, completed a differential level run from the National Geodetic Survey Bench Mark designated as S 484, located in the Northwest quarter of Section 18, Township 19 North, Range 17 West to the Subsidence Benchmark set by Mohave Engineering Associates, Inc. in November, 1998, located in the Southeast quarter of the Southwest quarter of Section 10, Township 19 North, Range 18 West of the Gila and Salt River Meridian, Mohave County, Arizona.

The results of this differential level circuit indicate that there has been no subsidence or elevation change at the Subsidence Monument from the time the original level circuit was performed on November 20, 1998 and the current level circuit completed on January 20, 2003.

Respectfully,

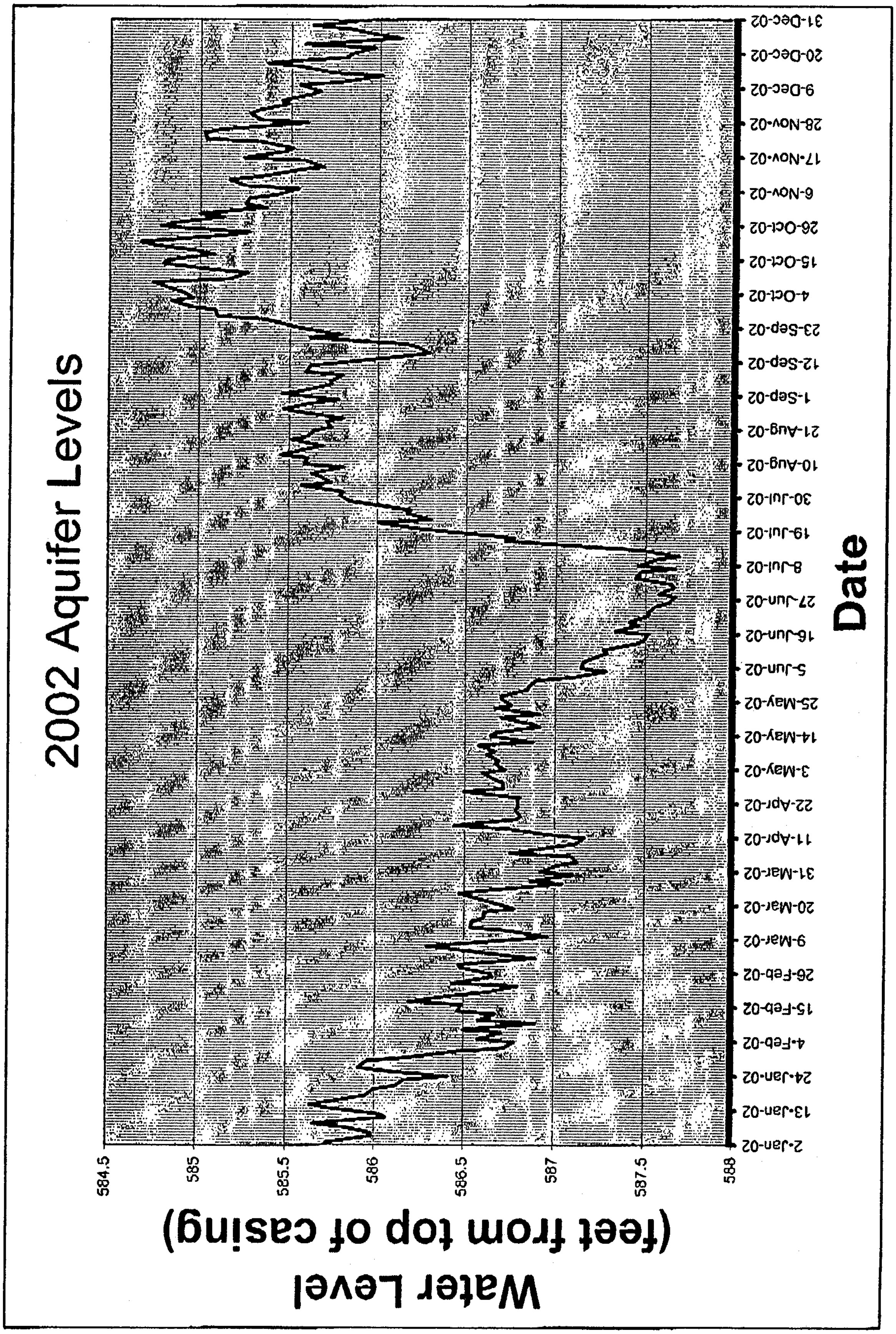
Craig T. Micek

Craig T. Micek, R.L.S. 31600

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
31600
CRAIG T.
MICEK
Date Signed 1/23/03
ARIZONA U.S.A.

Craig T. Micek

405 E. Beale St. • Kingman, AZ 86401 • Ph. 928-753-2627 • FAX 928-753-9118


2002 Aquifer Levels
Water Level
(feet from top of casing)
584.5
585
585.5
586
586.5
587
587.5
588
Date
2-Jan-02
13-Jan-02
24-Jan-02
4-Feb-02
15-Feb-02
26-Feb-02
9-Mar-02
20-Mar-02
31-Mar-02
11-Apr-02
22-Apr-02
3-May-02
14-May-02
25-May-02
5-Jun-02
16-Jun-02
27-Jun-02
8-Jul-02
19-Jul-02
30-Jul-02
10-Aug-02
21-Aug-02
1-Sep-02
12-Sep-02
23-Sep-02
4-Oct-02
15-Oct-02
26-Oct-02
6-Nov-02
17-Nov-02
28-Nov-02
9-Dec-02
20-Dec-02
31-Dec-02

2003

PRIMESOUTH
A SCANA COMPANY

PALMARK
A PRIMESOUTH COMPANY

P.O. Box 3519
Kingman, AZ 86402
(928) 718-0102
Fax (928) 718-0727

January 27, 2004

Arizona Department of Water Resources
Attn: Mr. Greg Wallace – Chief Hydrologist
500 North Third Street
Phoenix, AZ 85004

Subject: Griffith Energy Environmental Compatibility Report

Dear Mr. Wallace,

As required under conditions 4 and 5 of Griffith Energy, LLC's Certificate of Environmental Compatibility, enclosed are the following: (1) Subsidence Monitoring Report; (2) In-situ well linear data; and (3) a graph depicting real time data of 2003 changes in depth to water below ground level in monitor well no. 3 at the Mohave County Griffith well field.

The certified engineers report states, there has been no subsidence or elevation changes at the subsidence monument from the time the original level circuit was performed on November 20, 1998.

The graph, representing real time data, indicates that groundwater in the vicinity of well no. 3 has risen over the past year by approximately 4 feet. This is probably due in part to the usage of groundwater in 2003. Griffith Energy used 109,666,000 fewer gallons than from the previous year. Please see the attached production well monthly usage table.

If you should have any questions please call Brian Henderson, the site Safety & Environmental Coordinator, at (928) 718-0102 ext. 227, or myself at ext. 222.

Sincerely,

Rex LaMew

Rex LaMew
Plant Manager
Griffith Energy Project

Cc: Brenda Long
Darren Stevens
Jim Parker
David S. Miller

File 1404-080-56

MOHAVE ENGINEERING ASSOCIATES, INC.
- CONSULTING CIVIL ENGINEERS & LAND SURVEYORS -

Joseph R. Leedy, P.E.
Vice President / Engineering Mgr.

Peter J. Proffit, P.E.
President

Thomas R. Christopher, R.L.S.
Vice President / Surveying Manager

January 26, 2004

Mr. Brian Henderson
Environmental Safety Manager
Griffith Energy , L.L.C.
P.O. Box 3519
Kingman, Arizona 86402

Dear Mr. Henderson:

I, Craig T. Micek, Land Surveyor in the State of Arizona, Registration No. 31600 hereby state the following:

During the period from January 16, 2004 to January 26, 2004, Mohave Engineering Associates, Inc., under my direct supervision, has completed a differential level run from the National Geodetic Survey Bench Mark designated as S 484, located in the North West quarter of Section 10, Township 19 North, Range 18 West of the Gila and Salt River Meridian, Mohave County, Arizona.

The results of this differential level circuit indicate that there has been no subsidence or elevation change at the Subsidence Monument from the time the original level circuit was performed on November 20, 1998 and the current level circuit completed on January 26, 2004.

Respectfully,

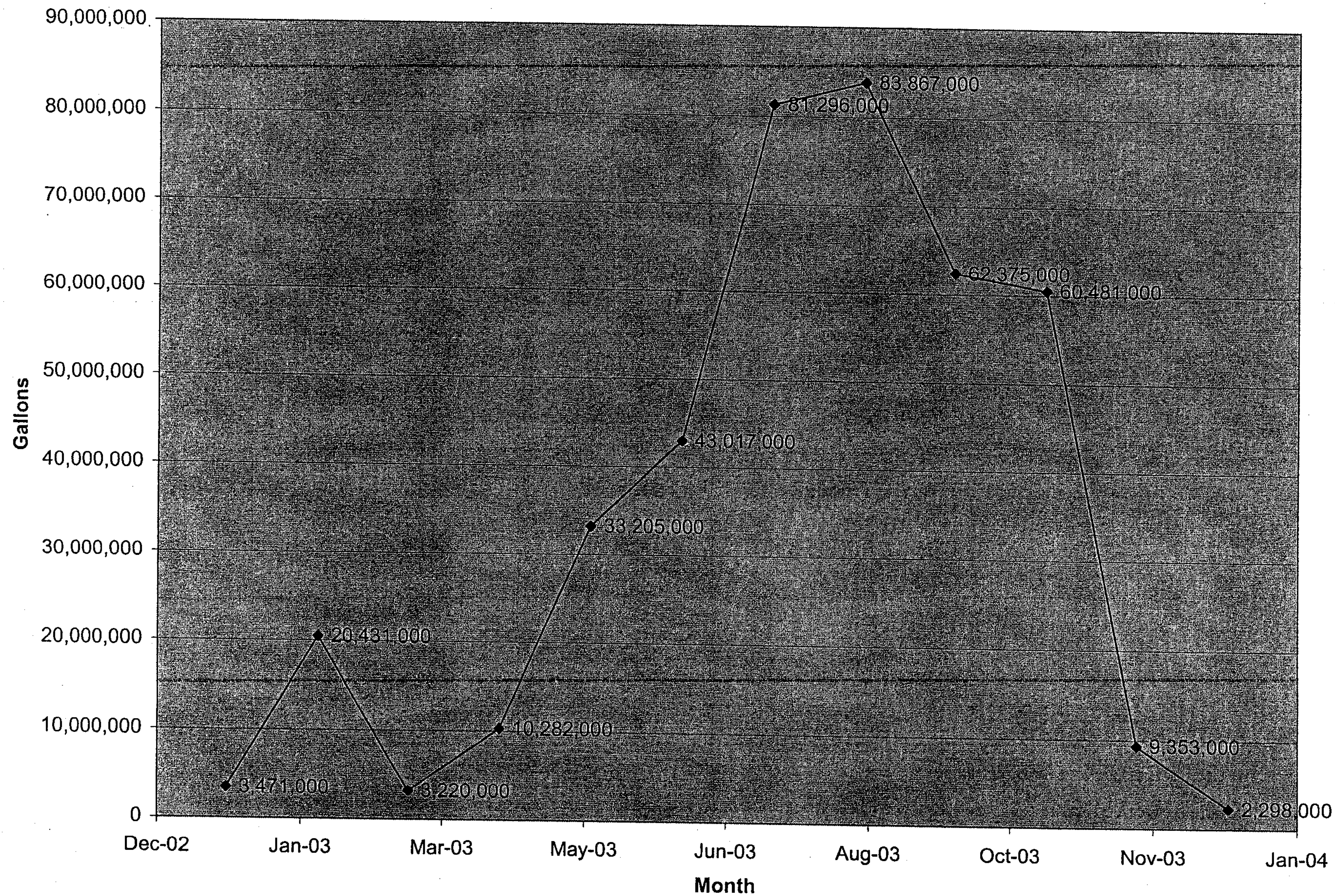
Craig T. Micek

Craig T. Micek,
R.L.S. 31600

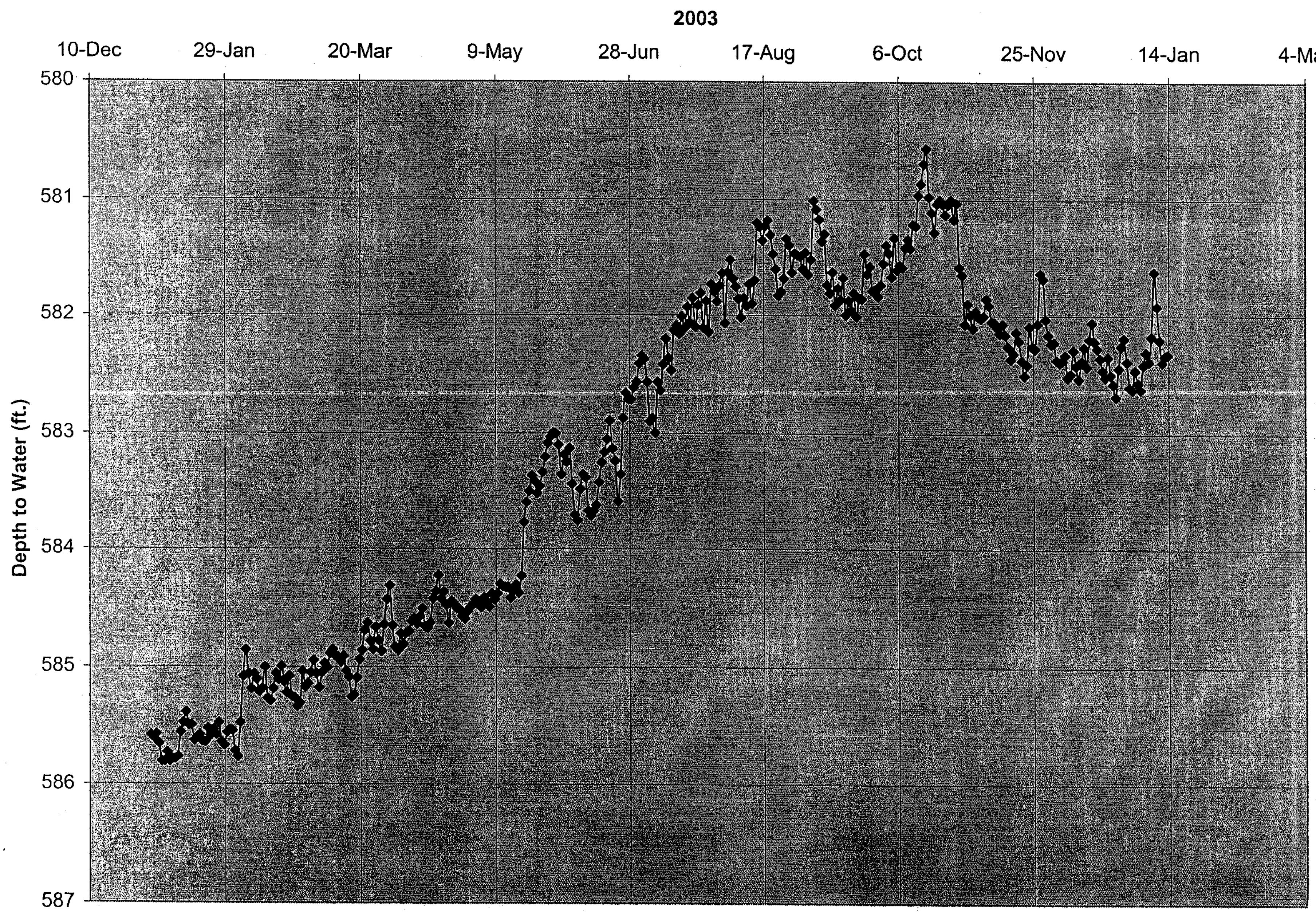
REGISTERED LAND SURVEYOR
CERTIFICATE NO.
31600
CRAIG T.
MICEK
Date Signed 1/27/04
ARIZONA U.S.A.

405 E. Beale St. • Kingman, AZ 86401 • Ph. 928-753-2627 • FAX 928-753-9118
www.mohave-engineering.com

Griffith Well #3 Monthly Water Usage For 2003



Griffith Energy Production Well #3 - Depth To Water Over Time



2003 Monthly Water Usage - Griffith Power Plant - Griffith Well #3

Month	Gallons
Jan-03	3,471,000
Feb-03	20,431,000
Mar-03	3,220,000
Apr-03	10,282,000
May-03	33,205,000
Jun-03	43,017,000
Jul-03	81,296,000
Aug-03	83,867,000
Sep-03	62,375,000
Oct-03	60,481,000
Nov-03	9,353,000
Dec-03	2,298,000
Total 2003 Usage:	**413,296,000**

2002 Monthly Water Usage - Griffith Power Plant - Griffith Well #3

Month	Gallons
Jan-02	21,574,000
Feb-02	45,932,000
Mar-02	36,848,000
Apr-02	30,323,000
May-02	22,615,000
Jun-02	71,475,000
Jul-02	78,456,000
Aug-02	75,958,000
Sep-02	56,920,000
Oct-02	26,193,000
Nov-02	27,897,000
Dec-02	28,771,000
Total 2002 Usage:	**522,962,000**

Griffith Energy used **109,666,000** fewer gallons than from the previous year.

2004

PRIMESOUTH
A SCANA COMPANY

PALMARK
A PRIMESOUTH COMPANY

P.O. Box 3519
Kingman, AZ 86402
(928) 718-0102
Fax (928) 718-0727

January 10, 2005

Arizona Department of Water Resources
Attn: Mr. Greg Wallace – Chief Hydrologist
500 North Third Street
Phoenix, AZ 85004

Subject: Griffith Energy Environmental Compatibility Report

Dear Mr. Wallace,

As required under conditions 4 and 5 of Griffith Energy, LLC's Certificate of Environmental Compatibility, we have enclosed the following: (1) Subsidence Monitoring Report; (2) Monthly water usage with associated graph and comparative information for Well # 3 at the Mohave County well field.

The certified engineers report states, there has been no subsidence or elevation changes at the subsidence monument from the time the original level circuit was performed on November 20, 1998. The monthly water usage data indicates that Griffith Energy used 48,583,000 fewer gallons than from the previous year.

Regrettably, real-time water level data is not available due to an electronic data logger failure. The data logger unit has been sent to the manufacturer for repair and will be back in-service within January, 2005.

If you should have any questions please call Brian Henderson, the site Safety & Environmental Coordinator, at (928) 718-0102 ext. 227, or myself at ext. 222.

Sincerely,

Rex LaMew
Plant Manager
Griffith Energy Project

Cc: David A. Gillespie
Charles Baker
Brenda Long
David S. Miller

File: 404-080-56

MOHAVE ENGINEERING ASSOCIATES, INC.

2202 Stockton Hill Road Ste A
KINGMAN, AZ. 86401
928-753-2627
928-753-9118 (FAX)

December 6, 2004

Mr. Brian Henderson
Environmental Safety manager
Griffith Energy
PO Box 3519
Kingman, AZ 86402

Dear Mr. Henderson:

I, Craig T. Micek, Land Surveyor in the State of Arizona, Registration No. 31600 , hereby state the following:

That during the period from November23 to November 29, 2004, Mohave Engineering Associates, Inc., under my direct supervision, completed a differential level run from the National Geodetic Survey Bench Mark designated as S 484, located in the Northwest quarter of Section 18, Township 19 North, Range 17 West to the Subsidence Bench Mark set by Mohave Engineering Associates, Inc. in November, 1998, located in the Southeast quarter of the Southwest quarter of Section 10, Township 19 North, Range 18 West of the Gila and Salt River Meridian, Mohave County, Arizona.

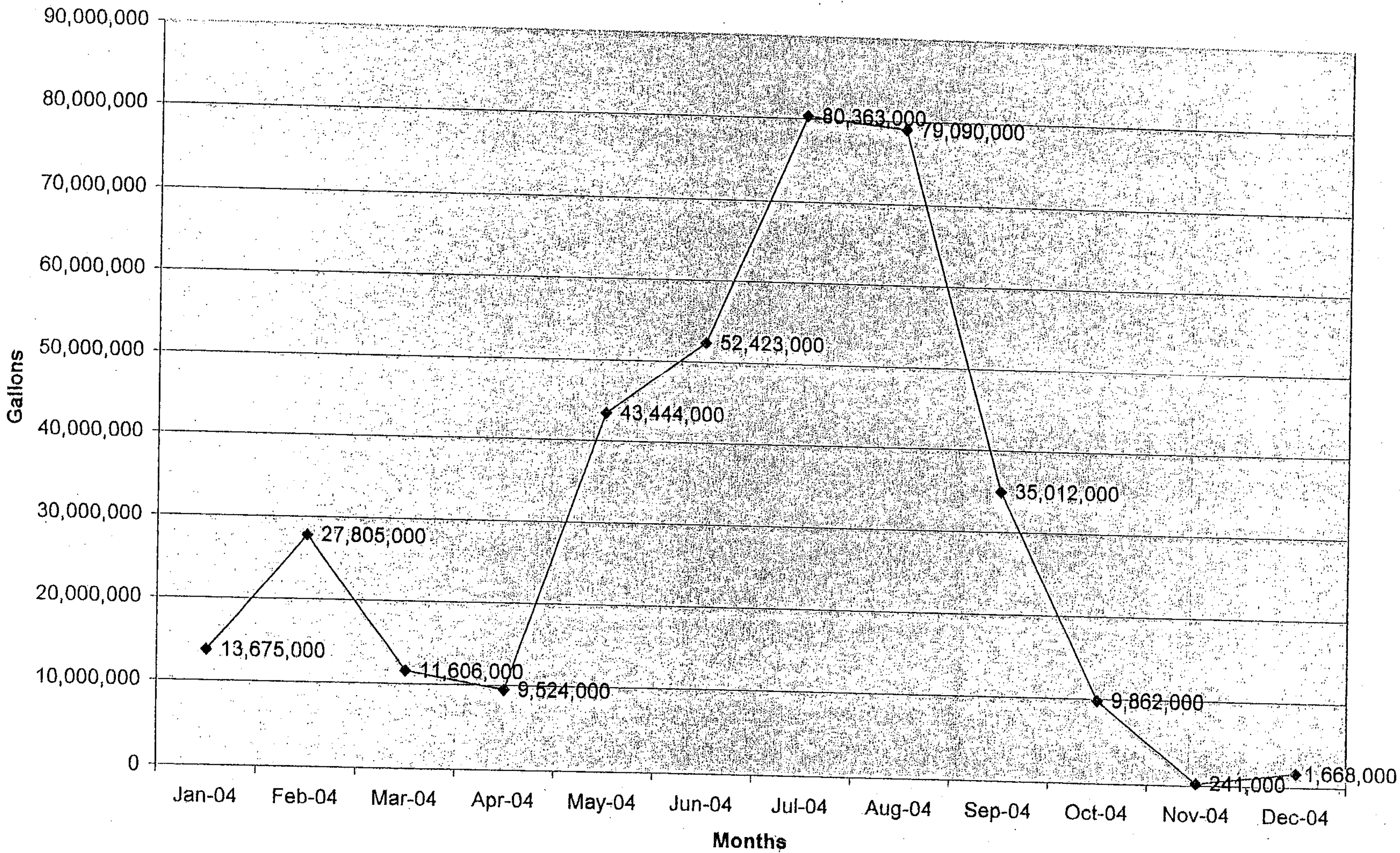
The results of this differential level circuit indicate that there has been no subsidence or elevation change at the Subsidence Monument from the time the original level circuit was performed on November 20, 1998 and the current level circuit completed on November 29, 2004.

Respectfully,

REGISTERED LAND SURVEYOR CERTIFICATE 31600 CRAIG T. MICEK ARIZONA U.S.A. 12/7/04

Craig T. Micek, R.L.S. 31600

2004 Griffith Energy Water Usage



2003 Monthly Water Usage - Griffith Power Plant

Month	Gallons
Jan-03	3,471,000
Feb-03	20,431,000
Mar-03	3,220,000
Apr-03	10,282,000
May-03	33,205,000
Jun-03	43,017,000
Jul-03	81,296,000
Aug-03	83,867,000
Sep-03	62,375,000
Oct-03	60,481,000
Nov-03	9,353,000
Dec-03	2,298,000

Total 2003 Usage:	**413,296,000**	gal/year
Ave 2003 Usage:	47,149	gal/hr
	786	gal/min

2004 Monthly Water Usage - Griffith Power Plant

Month	Gallons
Jan-04	13,675,000
Feb-04	27,805,000
Mar-04	11,606,000
Apr-04	9,524,000
May-04	43,444,000
Jun-04	52,423,000
Jul-04	80,363,000
Aug-04	79,090,000
Sep-04	35,012,000
Oct-04	9,862,000
Nov-04	241,000
Dec-04	1,668,000

Total 2004 Usage:	**364,713,000**	gal/yr
Ave 2004 Usage:	41,606	gal/hr
	693	gal/hr

Griffith Energy used **48,583,000** fewer gallons than from the previous year.

2005

PRIMESOUTH℠
A SCANA COMPANY

PALMARK℠
A PRIMESOUTH COMPANY

P.O. Box 3519
Kingman, AZ 86402
(928) 718-0102
Fax (928) 718-0727

January 26, 2006

Arizona Department of Water Resources
Attn: Mr. Greg Wallace – Chief Hydrologist
500 North Third Street
Phoenix, AZ 85004

Subject: Griffith Energy Environmental Compatibility Report

Dear Mr. Wallace,

As required under conditions 4 and 5 of Griffith Energy, LLC's Certificate of Environmental Compatibility, we have enclosed the following: (1) Subsidence Monitoring Report; (2) Monthly water usage with associated graph and comparative information for Well # 3 at the Mohave County well field.

The certified engineers report states, there has been no subsidence or elevation changes at the subsidence monument from the time the original level circuit was performed on November 20, 1998. The monthly water usage data indicates that Griffith Energy used 80,268,000 fewer gallons than from the previous year.

If you should have any questions please call Brian Henderson, the site Safety & Environmental Coordinator, at (928) 718-0102 ext. 227, or myself at ext. 222.

Sincerely,

Rex LaMew

Rex LaMew
Plant Manager
Griffith Energy Project

Cc: David A. Gillespie
Charles Baker
Brenda Long

File: 404-080-56

MOHAVE ENGINEERING ASSOCIATES, INC.

January 25, 2006

Mr. Brian Henderson
Environmental Safety Manager
Griffith Energy
P.O. Box 3519
Kingman, AZ 86402

Dear Mr. Henderson:

I, Justin Wright, Land Surveyor in the State of Arizona, Registration No. 43351, hereby state the following:

That during the period from December 6, 2005 to December 7, 2005, Mohave Engineering Associates, Inc., under my direct supervision, completed a differential level run from the National Geodetic Survey Bench Mark designated as S 484, located in the Northwest quarter of Section 18, Township 19 North, Range 17 West to the Subsidence monuments located on the Brine Pond dam on the Griffith Energy property located in the southeast quarter, Section 6, Township 19 N, Range 17 West of the Gila and Salt River Meridian, Mohave County, Arizona.

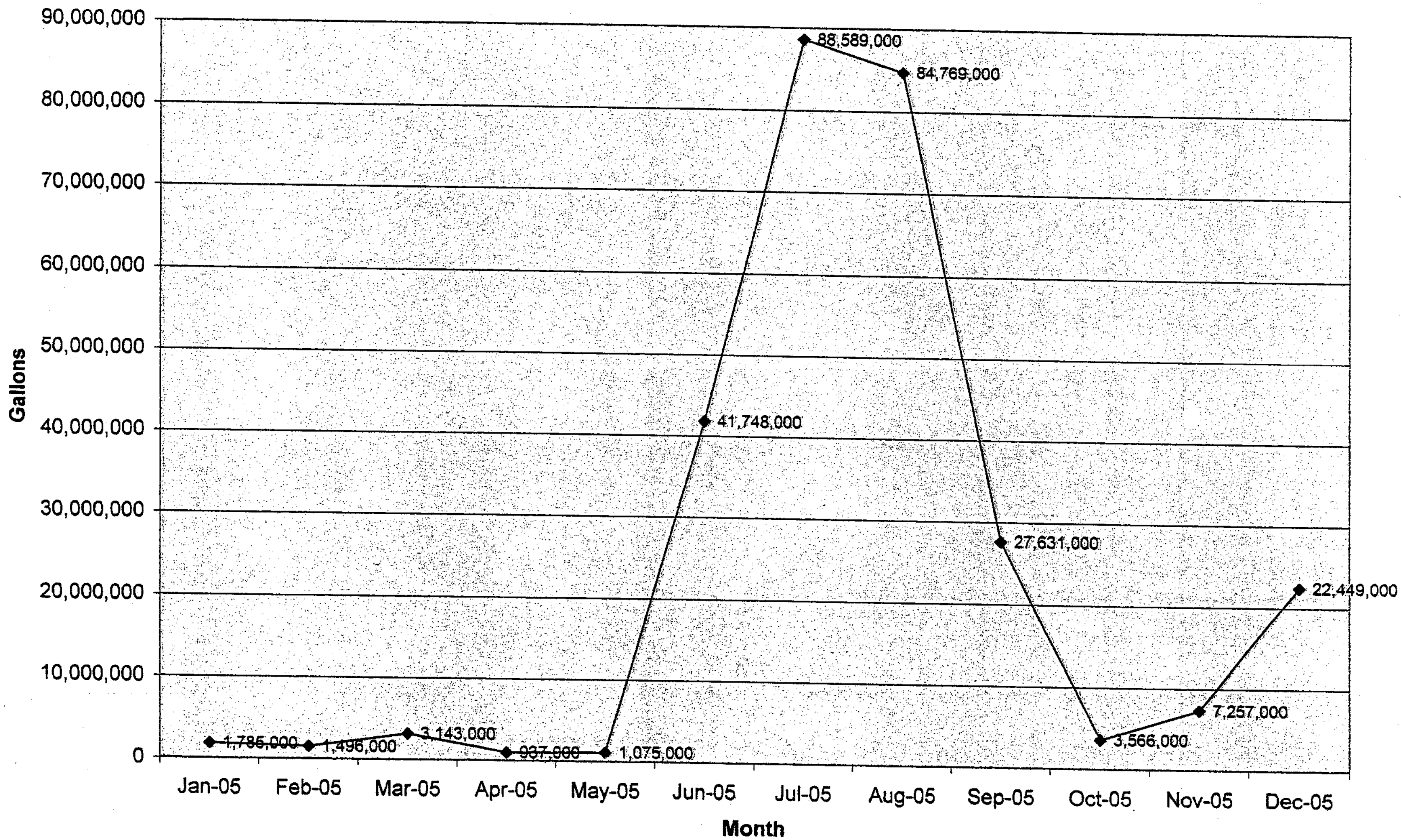
The results of this differential level circuit indicate that there has been no subsidence or elevation change at the Subsidence Monument from the time the original level circuit was performed on August, 2001 and the current level circuit completed on December 7, 2005.

Respectfully,

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
43351
S. JUSTIN
WRIGHT
Date Signed 1/25/06
ARIZONA, U.S.A.

Justin Wright, R.L.S. 43351

2005 Griffith Energy Water Usage



Monthly Water Usage - Griffith Energy Power Plant

2005 Month		**2004** Month	Gallons
Jan-05	1,785,000	Jan-04	13,675,000
Feb-05	1,496,000	Feb-04	27,805,000
Mar-05	3,143,000	Mar-04	11,606,000
Apr-05	937,000	Apr-04	9,524,000
May-05	1,075,000	May-04	43,444,000
Jun-05	41,748,000	Jun-04	52,423,000
Jul-05	88,589,000	Jul-04	80,363,000
Aug-05	84,769,000	Aug-04	79,090,000
Sep-05	27,631,000	Sep-04	35,012,000
Oct-05	3,566,000	Oct-04	9,862,000
Nov-05	7,257,000	Nov-04	241,000
Dec-05	22,449,000	Dec-04	1,668,000
	284,445,000 GALLONS		364,713,000 GALLONS
	779,301 GPD		996,484 GPD

Griffith Energy used **80,268,000** fewer gallons than from the previous year.

2006

PRIMESOUTH
A SCANA COMPANY

PALMARK
A PRIMESOUTH COMPANY

P.O. Box 3519
Kingman, AZ 86402
(928) 718-0102
Fax (928) 718-0727

January 10, 2007

Arizona Department of Water Resources
Attn: Mr. Greg Wallace – Chief Hydrologist
500 North Third Street
Phoenix, AZ 85004

Subject: Griffith Energy Environmental Compatibility Report

Dear Mr. Wallace,

As required under conditions 4 and 5 of Griffith Energy, LLC's Certificate of Environmental Compatibility, we have enclosed the following: (1) Subsidence Monitoring Reports; (2) Monthly water usage for Well # 3 at the Mohave County well field; and (3) Water table data with graphical representation.

The certified engineers report states, there has been no subsidence or elevation changes at the subsidence monument from the time the original level circuit was performed on November 20, 1998.

If you should have any questions please call Brian Henderson, the site Safety & Environmental Coordinator, at (928) 718-0102 ext. 227, or myself at ext. 222.

Sincerely,

Rex LaMew

Rex LaMew
Plant Manager
Griffith Energy Project

Cc: Jim Hinrichs
Brenda Long

File: 404-080-56

MOHAVE ENGINEERING ASSOCIATES, INC.

CIVIL ENGINEERING • LAND SURVEYING

November 21. 2006

Mr. Brian Henderson
Environmental Safety Manager
Griffith Energy
P.O. Box 3519
Kingman, AZ 86402

Dear Mr Henderson:

I. Tom Christopher. Land Surveyor in the State of Arizona, Registration No. 24514 hereby state the following:

That during the period from November 03 2006 to November 07, 2006, Mohave Engineering Associates, Inc.. under my direct supervision, completed a differential level run from National Geodetic Survey Bench mark designated as S 484, located in the Northwest quarter of Section 18, Township 19 North, Range 17 West to Subsidence monuments located on the Brine Pond dam on the Griffith Energy property located in the Southeast quarter Section 6, Township 19 N, Range 17 West of the Gila and Salt River Meridian. Mohave County, Arizona

The results of this differential level circuit indicate that there has been no subsidence or elevation change at the Subsidence Monument from the time the original level circuit was performed on August, 2001 and the current level circuit completed on November 07. 2006.

Respectfully,

Thomas R Christopher

Tom Christopher. R L S 24514

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
24514
THOMAS R.
CHRISTOPHER
Date Signed 11/27/06
ARIZONA, U.S.A.

J:\2006\06-557\Ltr to Brian Henderson Griffith Energy.doc

Monthly water usage - Griffith Power Plant

2006

Month	Gallons
Jan-06	1,696,000
Feb-06	706,000
Mar-06	666,000
Apr-06	1,485,000
May-06	320,000
Jun-06	7,128,000
Jul-06	37,712,000
Aug-06	101,325,000
Sep-06	86,280,000
Oct-06	78,776,000
Nov-06	53,232,000
Dec-06	42,667,000

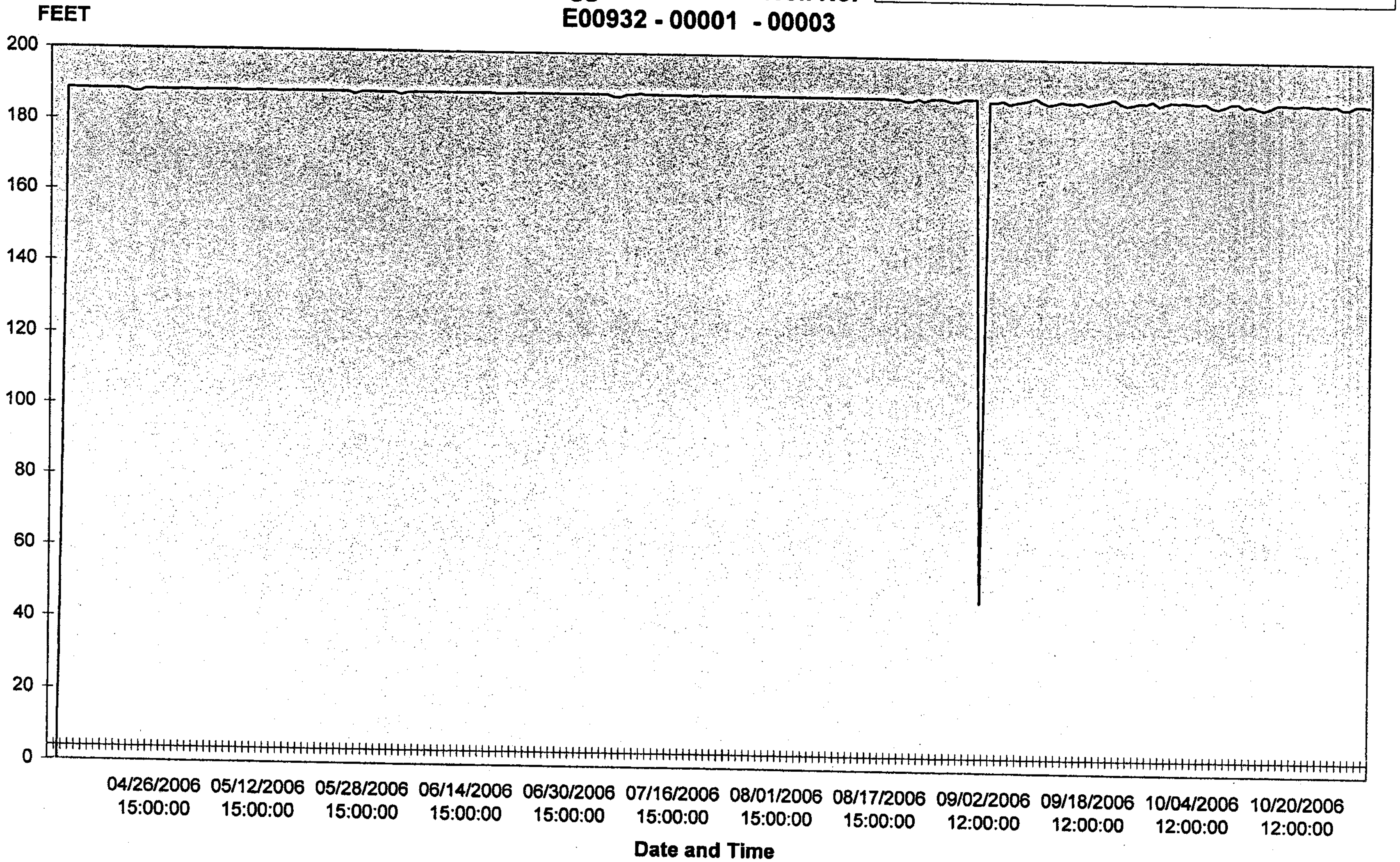
411,993,000 GALLONS

1,128,748 GPD

Graph shows trend only and should not be used for analytical purposes.

Logger ID-Job No.-Well No.
E00932 - 00001 - 00003

—— Comp. Ht. of Water abv. Transd.



Date and Time	Comp. Ht. of Water abv. Transd.
4/11/2006 15:12:46	0
4/12/2006 15:00:00	189
4/13/2006 15:00:00	189
4/14/2006 15:00:00	189
4/15/2006 15:00:00	189
4/16/2006 15:00:00	189
4/17/2006 15:00:00	189
4/18/2006 15:00:00	189
4/19/2006 15:00:00	189
4/20/2006 15:00:00	189
4/21/2006 15:00:00	189
4/22/2006 15:00:00	188
4/23/2006 15:00:00	188
4/24/2006 15:00:00	189
4/25/2006 15:00:00	189
4/26/2006 15:00:00	189
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4/30/2006 15:00:00	189
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5/2/2006 15:00:00	189
5/3/2006 15:00:00	189
5/4/2006 15:00:00	189
5/5/2006 15:00:00	189
5/6/2006 15:00:00	189
5/7/2006 15:00:00	189
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5/25/2006 15:00:00	189
5/26/2006 15:00:00	188
5/27/2006 15:00:00	189
5/28/2006 15:00:00	189
5/29/2006 15:00:00	189

Zero calibration check and does not represent aquifer level.

5/30/2006 15:00:00	189
6/1/2006 15:00:00	189
6/2/2006 15:00:00	189
6/3/2006 15:00:00	188
6/4/2006 15:00:00	189
6/5/2006 15:00:00	189
6/6/2006 15:00:00	189
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8/26/2006 15:00:00	189	
8/27/2006 15:00:00	188	
8/28/2006 15:00:00	188	
8/29/2006 15:00:00	189	
8/30/2006 15:00:00	189	
8/31/2006 15:00:00	189	
9/1/2006 12:00:00	47	Data logger removed for cleaning and calibration verification. This reading was from testing. It does not represent aquifer level
9/2/2006 12:00:00	188	
9/3/2006 12:00:00	188	
9/4/2006 12:00:00	188	
9/5/2006 12:00:00	188	
9/6/2006 12:00:00	188	
9/7/2006 12:00:00	188	
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10/28/2006 12:00:00	188
10/29/2006 12:00:00	188
10/30/2006 12:00:00	188

Monthly Usage Summary

Monthly water usage - Griffith Power Plant

2006		2005		2004		2003		2002		2001	
Month	Gallons	Month	Gallons	Month	Gallons	Month	Gallons	Month	Gallons	Month	Gallons
Jan-06	1,696,000	Jan-05	1,785,000	Jan-04	13,675,000	Jan-03	3,471,000	Jan-02	21,574,000	Jan-01	
Feb-06	706,000	Feb-05	1,496,000	Feb-04	27,805,000	Feb-03	20,431,000	Feb-02	45,932,000	Feb-01	
Mar-06	666,000	Mar-05	3,143,000	Mar-04	11,606,000	Mar-03	3,220,000	Mar-02	36,848,000	Mar-01	6,988,000
Apr-06	1,485,000	Apr-05	937,000	Apr-04	9,524,000	Apr-03	10,282,000	Apr-02	30,323,000	Apr-01	21,550,000
May-06	320,000	May-05	1,075,000	May-04	43,444,000	May-03	33,205,000	May-02	22,615,000	May-01	35,339,000
Jun-06	7,128,000	Jun-05	41,748,000	Jun-04	52,423,000	Jun-03	43,017,000	Jun-02	71,475,000	Jun-01	78,731,000
Jul-06	37,712,000	Jul-05	88,589,000	Jul-04	80,363,000	Jul-03	81,296,000	Jul-02	78,456,000	Jul-01	12,123,000
Aug-06	101,325,000	Aug-05	84,769,000	Aug-04	79,090,000	Aug-03	83,867,000	Aug-02	75,958,000	Aug-01	64,300,000
Sep-06	86,280,000	Sep-05	27,631,000	Sep-04	35,012,000	Sep-03	62,375,000	Sep-02	56,920,000	Sep-01	47,256,000
Oct-06	78,776,000	Oct-05	3,566,000	Oct-04	9,862,000	Oct-03	60,481,000	Oct-02	26,193,000	Oct-01	44,410,000
Nov-06	53,232,000	Nov-05	7,257,000	Nov-04	241,000	Nov-03	9,353,000	Nov-02	27,897,000	Nov-01	41,567,000
Dec-06	42,667,000	Dec-05	22,449,000	Dec-04	1,668,000	Dec-03	2,298,000	Dec-02	28,771,000	Dec-01	8,402,000
	411,993,000 GALLONS		284,445,000 GALLONS		364,713,000 GALLONS		413,296,000 GALLONS		522,962,000 GALLONS		360,666,000 GALLONS
	1,128,748 GPD		779,301 GPD		996,484 GPD		1,132,318 GPD		1,432,773 GPD		1,178,647 GPD

B

Evaluation of the Pumping Impact of the Northern Arizona Energy Project (NAEP) on the Mohave County Water System Well Field and the Sacramento Valley Aquifer, Mohave County, AZ, prepared by Southwest Ground-water Consultants, Inc. (Submitted under separate binding)

C

DRAFT

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY CLASS I PERMIT

COMPANY: *Northern Arizona Energy, LLC*
FACILITY: *Northern Arizona Energy Project*
PERMIT #: *43801*
DATE ISSUED: *Draft*
EXPIRY DATE:

SUMMARY

This operating permit is issued to Northern Arizona Energy, LLC the Permittee, for the operation a gas-fired peaking power generation plant. The facility will be located approximately 3 miles north of Griffith Interchange on Interstate 40 in Mohave County, Arizona. The Northern Arizona Energy Project (NAEP) will interconnect with the Western Area Power Administration (WAPA) transmission system at the Griffith Switchyard. The project location is in an area designated as attainment for all criteria pollutants.

The project is designed to serve peak load requirements of customers in Mohave County and surrounding regional load centers. The project will be constructed in a phased manner, and at full capacity, the project will have four (4) combustion turbine generators (CTG), 48 MW each. The CTGs will be fired exclusively on natural gas and will use water injection systems to control nitrogen oxide (NO_X) emissions. In addition, a selective catalytic reduction (SCR) system will be used to further reduce NOx emissions, and oxidation catalyst will be used to reduce carbon monoxide (CO) and volatile organic compound (VOC) emissions. Each CTG will also be equipped with a SPRINT (SPRay INTercooling) system to enhance turbine efficiency and preserve peak output during the hottest ambient temperature days. A chiller system will be utilized to cool the incoming air to improve turbine efficiency. Other auxiliary equipment include air filter, chiller coils, water treatment equipment, natural gas compressors, transformers and water storage tanks.

Due to the proposed common management of NAEP and Griffith Energy (operating under a Class I Title V permit) and location on contiguous property, the operations at NAEP and Griffith Energy have been evaluated as a single "stationary source". At the request of the Permittee, a separate Class I Title V Permit is being issued for the facility. NAE has proposed voluntary emission limitations with pollution controls (water injection and SCR for control of nitrogen oxides, and oxidation catalyst for control of carbon monoxide emissions) to ensure that the emissions from the facility remain below significance levels. Thus, the NAE operations will not be subject to New Source Review (NSR).

Continuous emissions monitoring systems (CEMS), fuel flow monitoring, and data acquisition and handling systems (DAHS) will be utilized to demonstrate compliance with applicable NO_X and CO emission limitations for CTGs, including New Source Performance Standards (NSPS) Subpart KKKK (NO_X and SO_2) and synthetic minor limitations (NO_X, CO, SO_2, VOCs, and PM_{10}).

This permit is issued in accordance with Title 49, Chapter 3 of Arizona Revised Statutes. All definitions, terms, and conditions used in this permit conform to those in Arizona Administrative Code (A.A.C.) R18-2-101 et. seq. and Title 40, Code of Federal Regulations (CFR), except as otherwise defined in this permit. Unless noted otherwise, references cited in the permit conditions refer to the A.A.C. All material permit conditions have been identified within the permit by underline and italics. All terms and conditions in this permit are enforceable by the Administrator of the United States Environmental Protection Agency (U.S. EPA), except for those terms and conditions that have been designated as "State requirements."

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TABLE OF CONTENTS

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ATTACHMENT "A": GENERAL PROVISIONS

Air Quality Control Permit No. 43801
for
Northern Arizona Energy, LLC

I. PERMIT EXPIRATION AND RENEWAL [ARS § 49-426.F, A.A.C. R18-2-304.C.2, and -306.A.1]

A. This permit is valid for a period of five years from the date of issuance.

B. The Permittee shall submit an application for renewal of this permit at least 6 months, but not more than 18 months, prior to the date of permit expiration.

II. COMPLIANCE WITH PERMIT CONDITIONS [A.A.C. R18-2-306.A.8.a and b]

A. The Permittee shall comply with all conditions of this permit including all applicable requirements of the Arizona air quality statutes and air quality rules. Any permit noncompliance constitutes a violation of the Arizona Revised Statutes and is grounds for enforcement action; for permit termination, revocation and reissuance, or revision; or for denial of a permit renewal application. In addition, noncompliance with any federally enforceable requirement constitutes a violation of the Clean Air Act.

B. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

III. PERMIT REVISION, REOPENING, REVOCATION AND REISSUANCE, OR TERMINATION FOR CAUSE [A.A.C. R18-2-306.A.8.c, -321.A.1, and -321.A.2]

A. The permit may be revised, reopened, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for a permit revision, revocation and reissuance, termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.

B. The permit shall be reopened and revised under any of the following circumstances

1. Additional applicable requirements under the Clean Air Act become applicable to the Class I source. Such a reopening shall only occur if there are three or more years remaining in the permit term. The reopening shall be completed no later than 18 months after promulgation of the applicable requirement. No such reopening is required if the effective date of the requirement is later than the date on which the permit is due to expire, unless an application for renewal has been submitted pursuant to A.A.C. R18-2-322.B. Any permit revision required pursuant to this subparagraph shall comply with the provisions in A.A.C. R18-2-322 for permit renewal and shall reset the five-year permit term.

2. Additional requirements, including excess emissions requirements, become applicable to an affected source under the acid rain program. Upon approval by the Administrator, excess emissions offset plans shall be deemed to be incorporated into the Class I permit.

3. The Director or the Administrator determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit.

4. The Director or the Administrator determines that the permit needs to be revised or revoked to assure compliance with the applicable requirements.

C. Proceedings to reopen and reissue a permit, including appeal of any final action relating to a permit reopening, shall follow the same procedures as apply to initial permit issuance and shall, except for reopenings under Condition III.B.1 above, affect only those parts of the permit for which cause to reopen exists. Such reopenings shall be made as expeditiously as practicable. Permit reopenings for reasons other than those stated in Condition III.B.1 above shall not result in a resetting of the five-year permit term.

IV. POSTING OF PERMIT [A.A.C. R18-2-315]

A. The Permittee shall post this permit or a certificate of permit issuance where the facility is located in such a manner as to be clearly visible and accessible. All equipment covered by this permit shall be clearly marked with one of the following:

1. Current permit number; or

2. Serial number or other equipment ID number that is also listed in the permit to identify that piece of equipment.

B. A copy of the complete permit shall be kept on site.

V. FEE PAYMENT [A.A.C. R18-2-306.A.9 and -326]

The Permittee shall pay fees to the Director pursuant to ARS § 49-426(E) and A.A.C. R18-2-326.

VI. ANNUAL EMISSION INVENTORY QUESTIONNAIRE [A.A.C. R18-2-327.A and B]

A. The Permittee shall complete and submit to the Director an annual emissions inventory questionnaire. The questionnaire is due by March 31st or ninety days after the Director makes the inventory form available each year, whichever occurs later, and shall include emission information for the previous calendar year.

B. The questionnaire shall be on a form provided by the Director and shall include the information required by A.A.C. R18-2-327.

VII. COMPLIANCE CERTIFICATION [A.A.C. R18-2-309.2.a, -309.2.c-d, and -309.5.d]

A. The Permittee shall submit a compliance certification to the Director semiannually, which describes the compliance status of the source with respect to each permit condition. The first certification shall be submitted no later than May 15th, and shall report the compliance status of the source during the period between October 1st of the previous year and March 31st of the current year. The second certification shall be submitted no later than November 15th, and shall report the compliance status of the source during the period between April 1st and September 30th of the current year.

The compliance certifications shall include the following:

1. Identification of each term or condition of the permit that is the basis of the certification;

2. Identification of the methods or other means used by the Permittee for determining the compliance status with each term and condition during the certification period,

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3. The status of compliance with the terms and conditions of the permit for the period covered by the certification, including whether compliance during the period was continuous or intermittent. The certification shall be based on the methods or means designated in Condition VII.A.2 above. The certifications shall identify each deviation and take it into account for consideration in the compliance certification;

4. For emission units subject to 40 CFR Part 64, the certification shall also identify as possible exceptions to compliance any period during which compliance is required and in which an excursion or exceedance defined under 40 CFR Part 64 occurred;

5. All instances of deviations from permit requirements reported pursuant to Condition XII.B of this Attachment; and

6. Other facts the Director may require to determine the compliance status of the source.

B. A copy of all compliance certifications shall also be submitted to the EPA Administrator.

C. If any outstanding compliance schedule exists, a progress report shall be submitted with the semi-annual compliance certifications required in Condition VII.A above.

VIII. CERTIFICATION OF TRUTH, ACCURACY AND COMPLETENESS [A.A.C. R18-2-304.H]

Any document required to be submitted by this permit, including reports, shall contain a certification by a responsible official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

IX. INSPECTION AND ENTRY [A.A.C. R18-2-309.4]

Upon presentation of proper credentials, the Permittee shall allow the Director or the authorized representative of the Director to:

A. Enter upon the Permittee's premises where a source is located, emissions-related activity is conducted, or where records are required to be kept under the conditions of the permit;

B. Have access to and copy, at reasonable times, any records that are required to be kept under the conditions of the permit;

C. Inspect, at reasonable times, any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit;

D. Sample or monitor, at reasonable times, substances or parameters for the purpose of assuring compliance with the permit or other applicable requirements; and

E. Record any inspection by use of written, electronic, magnetic and photographic media.

X. PERMIT REVISION PURSUANT TO FEDERAL HAZARDOUS AIR POLLUTANT STANDARD [A.A.C. R18-2-304.C]

If this source becomes subject to a standard promulgated by the Administrator pursuant to Section 112(d) of the Act, then the Permittee shall, within twelve months of the date on which the standard is promulgated, submit an application for a permit revision demonstrating how the source will comply with the standard.

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XI. ACCIDENTAL RELEASE PROGRAM [40 CFR Part 68]

If this source becomes subject to the provisions of 40 CFR Part 68, then the Permittee shall comply with these provisions according to the time line specified in 40 CFR Part 68.

XII. EXCESS EMISSIONS, PERMIT DEVIATIONS, AND EMERGENCY REPORTING

A. Excess Emissions Reporting [A.A.C. R18-2-310.01.A and -310.01.B]

1. Excess emissions shall be reported as follows:

   a. The Permittee shall report to the Director any emissions in excess of the limits established by this permit. Such report shall be in two parts as specified below:

      (1) Notification by telephone or facsimile within 24 hours of the time when the Permittee first learned of the occurrence of excess emissions including all available information from Condition XII.A.1.b below.

      (2) Detailed written notification by submission of an excess emissions report within 72 hours of the notification pursuant to Condition XII.A.1.a.(1) above.

   b. The report shall contain the following information:

      (1) Identity of each stack or other emission point where the excess emissions occurred;

      (2) Magnitude of the excess emissions expressed in the units of the applicable emission limitation and the operating data and calculations used in determining the magnitude of the excess emissions;

      (3) Date, time and duration, or expected duration, of the excess emissions;

      (4) Identity of the equipment from which the excess emissions emanated;

      (5) Nature and cause of such emissions;

      (6) If the excess emissions were the result of a malfunction, steps taken to remedy the malfunction and the steps taken or planned to prevent the recurrence of such malfunctions; and

      (7) Steps taken to limit the excess emissions. If the excess emissions resulted from start-up or malfunction, the report shall contain a list of the steps taken to comply with the permit procedures.

2. In the case of continuous or recurring excess emissions, the notification requirements of this section shall be satisfied if the source provides the required notification after excess emissions are first detected and includes in such notification an estimate of the time the excess emissions will continue. Excess emissions occurring after the estimated time period, or changes in the nature of the emissions as originally reported, shall require additional notification pursuant to Condition XII.A.1 above. [A.A.C. R18-2-310.01.C]

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B. Permit Deviations Reporting [A.A.C. R18-2-306.A.5.b]

The Permittee shall promptly report deviations from permit requirements, including those attributable to upset conditions as defined in the permit, the probable cause of such deviations, and any corrective actions or preventive measures taken. Prompt reporting shall mean that the report was submitted to the Director by certified mail, facsimile, or hand delivery within two working days of the time when emission limitations were exceeded due to an emergency or within two working days of the time when the owner or operator first learned of the occurrence of a deviation from a permit requirement.

C. Emergency Provision [A.A.C. R18-2-306.E]

1. An "emergency" means any situation arising from sudden and reasonable unforeseeable events beyond the control of the source, including acts of God, that require immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventative maintenance, careless or improper operation, or operator error.

2. An emergency constitutes an affirmative defense to an action brought for noncompliance with such technology-based emission limitations if Condition XII.C.3 is met.

3. The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An emergency occurred and that the Permittee can identify the cause(s) of the emergency;

   b. The permitted facility was being properly operated at the time;

   c. During the period of the emergency, the Permittee took all reasonable steps to minimize levels of emissions that exceeded the emissions standards or other requirements in the permit; and

   d. The Permittee submitted notice of the emergency to the Director by certified mail, facsimile, or hand delivery within two working days of the time when emission limitations were exceeded due to the emergency. This notice shall contain a description of the emergency, any steps taken to mitigate emissions, and corrective action taken.

4. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an emergency has the burden of proof.

5. This provision is in addition to any emergency or upset provision contained in any applicable requirement.

D. Compliance Schedule [ARS § 49-426.I.5]

For any excess emission or permit deviation that cannot be corrected within 72 hours, the Permittee is required to submit a compliance schedule to the Director within 21 days of such occurrence. The compliance schedule shall include a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance with the permit terms or conditions that have been violated.

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E. Affirmative Defenses for Excess Emissions Due to Malfunctions, Startup, and Shutdown

[A.A.C. R18-2-310]

1. Applicability

This rule establishes affirmative defenses for certain emissions in excess of an emission standard or limitation and applies to all emission standards or limitations except for standards or limitations:

a. Promulgated pursuant to Sections 111 or 112 of the Act;

b. Promulgated pursuant to Titles IV or VI of the Clean Air Act;

c. Contained in any Prevention of Significant Deterioration (PSD) or New Source Review (NSR) permit issued by the U.S. EPA;

d. Contained in A.A.C. R18-2-715.F; or

e. Included in a permit to meet the requirements of A.A.C. R18-2-406.A.5.

2. Affirmative Defense for Malfunctions

Emissions in excess of an applicable emission limitation due to malfunction shall constitute a violation. When emissions in excess of an applicable emission limitation are due to a malfunction, the Permittee has an affirmative defense to a civil or administrative enforcement proceeding based on that violation, other than a judicial action seeking injunctive relief, if the Permittee has complied with the reporting requirements of A.A.C. R18-2-310.01 and has demonstrated all of the following:

a. The excess emissions resulted from a sudden and unavoidable breakdown of process equipment or air pollution control equipment beyond the reasonable control of the Permittee;

b. The air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good practice for minimizing emissions;

c. If repairs were required, the repairs were made in an expeditious fashion when the applicable emission limitations were being exceeded. Off-shift labor and overtime were utilized where practicable to ensure that the repairs were made as expeditiously as possible. If off-shift labor and overtime were not utilized, the Permittee satisfactorily demonstrated that the measures were impracticable;

d. The amount and duration of the excess emissions (including any bypass operation) were minimized to the maximum extent practicable during periods of such emissions;

e. All reasonable steps were taken to minimize the impact of the excess emissions on ambient air quality;

f. The excess emissions were not part of a recurring pattern indicative of inadequate design, operation, or maintenance;

g. During the period of excess emissions there were no exceedances of the relevant ambient air quality standards established in Title 18, Chapter 2, Article 2 of the Arizona Administrative Code that could be attributed to the emitting source;

h. The excess emissions did not stem from any activity or event that could have been foreseen and avoided, or planned, and could not have been avoided by better operations and maintenance practices;

i. All emissions monitoring systems were kept in operation if at all practicable; and

j. The Permittee's actions in response to the excess emissions were documented by contemporaneous records

3. Affirmative Defense for Startup and Shutdown

a. Except as provided in Condition XII.E.3.b below, and unless otherwise provided for in the applicable requirement, emissions in excess of an applicable emission limitation due to startup and shutdown shall constitute a violation. When emissions in excess of an applicable emission limitation are due to startup and shutdown, the Permittee has an affirmative defense to a civil or administrative enforcement proceeding based on that violation, other than a judicial action seeking injunctive relief, if the Permittee has complied with the reporting requirements of A.A.C. R18-2-310.01 and has demonstrated all of the following:

(1) The excess emissions could not have been prevented through careful and prudent planning and design;

(2) If the excess emissions were the result of a bypass of control equipment, the bypass was unavoidable to prevent loss of life, personal injury, or severe damage to air pollution control equipment, production equipment, or other property;

(3) The air pollution control equipment, process equipment, or processes were at all times maintained and operated in a manner consistent with good practice for minimizing emissions;

(4) The amount and duration of the excess emissions (including any bypass operation) were minimized to the maximum extent practicable during periods of such emissions;

(5) All reasonable steps were taken to minimize the impact of the excess emissions on ambient air quality;

(6) During the period of excess emissions there were no exceedances of the relevant ambient air quality standards established in Title 18, Chapter 2, Article 2 of the Arizona Administrative Code that could be attributed to the emitting source;

(7) All emissions monitoring systems were kept in operation if at all practicable; and

(8) Contemporaneous records documented the Permittee's actions in response to the excess emissions.

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b. If excess emissions occur due to a malfunction during routine startup and shutdown, then those instances shall be treated as other malfunctions subject to Condition XII.E.2 above.

4. Affirmative Defense for Malfunctions during Scheduled Maintenance

If excess emissions occur due to a malfunction during scheduled maintenance, then those instances will be treated as other malfunctions subject to Condition XII.E.2 above.

5. Demonstration of Reasonable and Practicable Measures

For an affirmative defense under Condition XII.E.2 or XII.E.3 above, the Permittee shall demonstrate, through submission of the data and information required by Condition XII.E and A.A.C. R18-2-310.01, that all reasonable and practicable measures within the Permittee's control were implemented to prevent the occurrence of the excess emissions.

XIII. RECORD KEEPING REQUIREMENTS [A.A.C. R18-2-306.A.4]

A. The Permittee shall keep records of all required monitoring information including, but not limited to, the following:

1. The date, place as defined in the permit, and time of sampling or measurements;
2. The date(s) analyses were performed;
3. The name of the company or entity that performed the analyses;
4. A description of the analytical techniques or methods used;
5. The results of such analyses; and
6. The operating conditions existing at the time of sampling or measurement.

B. The Permittee shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records and all original strip-chart recordings or other data recordings for continuous monitoring instrumentation, and copies of all reports required by the permit.

C. All required records shall be maintained either in an unchangeable electronic format or in a handwritten logbook utilizing indelible ink.

XIV. REPORTING REQUIREMENTS [A.A.C. R18-2-306.A.5.a]

The Permittee shall submit the following reports:

A. Compliance certifications in accordance with Section VII of Attachment "A".

B. Excess emission; permit deviation, and emergency reports in accordance with Section XII of Attachment "A".

C. Other reports required by any condition of Attachment "B".

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XV. DUTY TO PROVIDE INFORMATION [A.A.C. R18-2-304.G and -306.A.8.e]

A. The Permittee shall furnish to the Director, within a reasonable time, any information that the Director may request in writing to determine whether cause exists for revising, revoking and reissuing, or terminating the permit, or to determine compliance with the permit. Upon request, the Permittee shall also furnish to the Director copies of records required to be kept by the permit. For information claimed to be confidential, the Permittee shall furnish an additional copy of such records directly to the Administrator along with a claim of confidentiality.

B. If the Permittee has failed to submit any relevant facts or has submitted incorrect information in the permit application, the Permittee shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information.

XVI. PERMIT AMENDMENT OR REVISION [A.A.C. R18-2-318, -319, and -320]

The Permittee shall apply for a permit amendment or revision for changes to the facility that do not qualify for a facility change without revision under Section XVII, as follows:

A. Administrative Permit Amendment (A.A.C. R18-2-318);

B. Minor Permit Revision (A.A.C. R18-2-319); and

C. Significant Permit Revision (A.A.C. R18-2-320)

The applicability and requirements for such action are defined in the above referenced regulations.

XVII. FACILITY CHANGE WITHOUT A PERMIT REVISION [A.A.C. R18-2-306.A.4 and -317]

A. The Permittee may make changes at the permitted source without a permit revision if all of the following apply:

1. The changes are not modifications under any provision of Title I of the Act or under ARS § 49-401.01(19);

2. The changes do not exceed the emissions allowable under the permit whether expressed therein as a rate of emissions or in terms of total emissions;

3. The changes do not violate any applicable requirements or trigger any additional applicable requirements;

4. The changes satisfy all requirements for a minor permit revision under A.A.C.-R18-2-319.A; and

5. The changes do not contravene federally enforceable permit terms and conditions that are monitoring (including test methods), record keeping, reporting, or compliance certification requirements.

B. The substitution of an item of process or pollution control equipment for an identical or substantially similar item of process or pollution control equipment shall qualify as a change that does not require a permit revision, if it meets all of the requirements of Conditions XVII.A and XVII.C of this Attachment.

C. For each change under Conditions XVII.A and XVII.B above, a written notice by certified mail or hand delivery shall be received by the Director and the Administrator a minimum of 7 working days in advance of the change. Notifications of changes associated with emergency conditions, such as malfunctions necessitating the replacement of equipment, may be provided less than 7 working days in advance of the change, but must be provided as far in advance of the change~~,~~ as possible or, if advance notification is not practicable, as soon after the change as possible.

D. Each notification shall include:

1. When the proposed change will occur;

2. A description of the change;

3. Any change in emissions of regulated air pollutants; and

4. Any permit term or condition that is no longer applicable as a result of the change.

E. The permit shield described in A.A.C. R18-2-325 shall not apply to any change made under this Section, other than implementation of an alternate to Conditions XVII.A and XVII.B above.

F. Except as otherwise provided for in the permit, making a change from one alternative operating scenario to another as provided under A.A.C. R18-2-306.A.11 shall not require any prior notice under this Section.

G. Notwithstanding any other part of this Section, the Director may require a permit to be revised for any change that, when considered together with any other changes submitted by the same source under this Section over the term of the permit, do not satisfy Condition XVII.A above.

XVIII. TESTING REQUIREMENTS [A.A.C. R18-2-312]

A. The Permittee shall conduct performance tests as specified in the permit and at such other times as may be required by the Director.

B. Operational Conditions during Testing

Tests shall be conducted during operation at the maximum possible capacity of each unit under representative operational conditions unless other conditions are required by the applicable test method or in this permit. With prior written approval from the Director, testing may be performed at a lower rate. Operations during periods of start-up, shutdown, and malfunction (as defined in A.A.C. R18-2-101) shall not constitute representative operational conditions unless otherwise specified in the applicable standard.

C. Tests shall be conducted and data reduced in accordance with the test methods and procedures contained in the Arizona Testing Manual unless modified by the Director pursuant to A.A.C. R18-2-312.B.

D. Test Plan

At least 14 calendar days prior to performing a test, the Permittee shall submit a test plan to the Director in accordance with A.A.C. R18-2-312.B and the Arizona Testing Manual. This test plan must include the following:

1. Test duration;

2. Test location(s);

3. Test method(s); and

4. Source operation and other parameters that may affect test results.

E. Stack Sampling Facilities

The Permittee shall provide, or cause to be provided, performance testing facilities as follows:

1. Sampling ports adequate for test methods applicable to the facility;

2. Safe sampling platform(s);

3. Safe access to sampling platform(s); and

4. Utilities for sampling and testing equipment.

F. Interpretation of Final Results

Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic mean of the results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs is required to be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the Permittee's control, compliance may, upon the Director's approval, be determined using the arithmetic mean of the results of the other two runs. If the Director or the Director's designee is present, tests may only be stopped with the Director's or such designee's approval. If the Director or the Director's designee is not present, tests may only be stopped for good cause. Good cause includes: forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the Permittee's control. Termination of any test without good cause after the first run is commenced shall constitute a failure of the test. Supporting documentation, which demonstrates good cause, must be submitted.

G. Report of Final Test Results

A written report of the results of all performance tests shall be submitted to the Director within 30 days after the test is performed. The report shall be submitted in accordance with the Arizona Testing Manual and A.A.C. R18-2-312.A.

XIX. PROPERTY RIGHTS [A.A.C. R18-2-306.A.8.d]

This permit does not convey any property rights of any sort, or any exclusive privilege.

XX. SEVERABILITY CLAUSE [A.A.C. R18-2-306.A.7]

The provisions of this permit are severable. In the event of a challenge to any portion of this permit, or if any portion of this permit is held invalid, the remaining permit conditions remain valid and in force.

XXI. PERMIT SHIELD [A.A.C. R18-2-325]

Compliance with the conditions of this permit shall be deemed compliance with all applicable requirements identified in the portions of this permit subtitled "Permit Shield". The permit shield shall not apply to minor revisions pursuant to Condition XVI.B of this Attachment and any facility changes without a permit revision pursuant to Section XVII of this Attachment.

XXII. PROTECTION OF STRATOSPHERIC OZONE [40 CFR Part 82]

If this source becomes subject to the provisions of 40 CFR Part 82, then the Permittee shall comply with these provisions accordingly.

ATTACHMENT "B": SPECIFIC CONDITIONS

Air Quality Control Permit No. 43801
for
Northern Arizona Energy, LLC

I. RELATIONSHIP OF PERMIT TO APPLICABLE STATE IMPLEMENTATION PLAN

This permit is issued pursuant to the provisions of the Arizona Revised Statutes (ARS) and constitutes an Installation Permit for the purpose of the applicable State Implementation Plan. [ARS § 49-404.c and -426]

II. FACILITY WIDE REQUIREMENTS

A. Within 7 days of site mobilization, the Permittee shall have on-site or on-call a person that is certified in EPA Reference Method 9 for the observation and evaluation of visible emissions. [A.A.C. R18-2-306.A.2]

B. At the time the compliance certification required by Section VII of Attachment "A" are submitted, the Permittee shall submit reports of all monitoring activities required by this Attachment performed in the same six month period as applies to the compliance certification period. [A.A.C. R18-2-306.A.5.a]

C. The Permittee shall keep a log of all emission related maintenance activities performed at the facility. These records shall be made available to ADEQ upon request. [A.A.C. R18-2-306.A.3.c]

III. COMBUSTION GAS TURBINES (CTGs)

A. Applicability

This section applies to the four (4) simple cycle combustion gas turbine units (CT1, CT2, CT3 and CT4).

B. General Provisions

The following requirements apply to the operation, maintenance, recordkeeping and testing of gas turbines and associated monitoring systems in accordance with 40 CFR Part 60, Subpart A – General Provisions.

1. All requests, reports, applications, submittals, and other communications to the Director pursuant to A.A.C. R18-2-901, -902, and 40 CFR Part 60 shall be submitted in duplicate to the EPA Region 9 office at the following addresses:

   Director, Air Division (Attn: AIR-1)
   U.S. Environmental Protection Agency
   75 Hawthorne Street
   San Francisco, CA 94105 [40 CFR 60.4(a)]

2. The Permittee shall comply with the general notification requirements contained in 40 CFR 60.7(a), including but not limited to:

   a. Notification of the date of construction of each affected CTG postmarked no later than 30 days after such date.

b. Notification of the actual date of initial startup of each affected CTG postmarked within 15 days after such date.

c. Notification of the date upon which demonstration of the continuous monitoring system performance commences in accordance with 40 CFR 60.13(c) postmarked not less than 30 days prior to such date. [40 CFR 60.7(a)]

3. The Permittee shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected CTG; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative. [40 CFR 60.7(b)]

4. The Permittee shall submit excess emissions and monitoring systems performance reports and/or summary report form on a semi-annual basis as required by 40 CFR 60.7(c) and (d). All reports shall be postmarked by the 30th day following the end of each 6-month period. [40 CFR 60.7(c), 40 CFR 60.7(d)]

5. The Permittee shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records, except as provided in 40 CFR 60.7(f)(1) and (2). [40 CFR 60.7(f)]

6. *<u>At all times, including periods of startup, shutdown, and malfunction, the Permittee shall, to the extent practicable,</u>* maintain and *<u>operate each combustion gas turbine including associated air pollution control equipment in a manner consistent with manufacturer equipment operating guidelines and good air pollution control practice for minimizing emissions</u>*. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.
[40 CFR 60.11(d), A.A.C. R18-2-331.A.3.e]
[Material permit conditions are indicated by underline and italics]

7. For the purpose of submitting compliance certifications or establishing whether or not the Permittee has violated or is in violation of any standard in 40 CFR Part 60, nothing shall preclude the use, including the exclusive use, of any credible evidence or information, relevant to whether a source would have been in compliance with applicable requirements if the appropriate performance or compliance test or procedure had been performed. [40 CFR 60.11(g)]

8. The Permittee shall not build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission, which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with opacity standard or with a standard, which is based on the concentration of a pollutant in the gases discharged to the atmosphere. [40 CFR 60.12]

9. The Permittee shall comply with the "General Notification and Reporting Requirements" found in 40 CFR 60.19. [40 CFR 60.19]

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10. State-only Enforceable NSPS Provisions

Until such time as Subpart KKKK of 40 CFR Part 60 is incorporated by reference into A.A.C. R18-2-901, the Permittee shall comply with all applicable provisions of Subpart GG of 40 CFR Part 60. [A.A.C. R18-2-901(40): State-only enforceable]

C. Operational Limitations

Fuel Limitation

The Permittee shall not cause or allow the combustion of any fuel in gas turbines other than natural gas meeting the definition of "natural gas" in 40 CFR 60.4420.

[A.A.C. R18-2-306.01.A, -306.A.2, -331.A.3.a]

[Material permit conditions are indicated by underline and italics]

D. Nitrogen Oxides

1. Emission Limitations/Standards

   a. The Permittee shall not cause to be discharged into the atmosphere any gas turbine gases which contain nitrogen oxides (NO_X) in excess of 25 ppm at 15% oxygen. [40 CFR 60.4320(a)]

   b. *Total combined emissions of NO_X from all the gas turbine units shall not exceed 39.0 tons per year, calculated daily as a rolling 365-day total.*

   [A.A.C. R18-2-306.01, -306.02, -331.A.3.a]

   [Material permit conditions are indicated by underline and italics]

2. Air Pollution Control Equipment

   a. *At all times when the gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall* maintain and *operate the water injection systems in a manner consistent with consistent with manufacturer equipment operating guidelines and good air pollution control practices for minimizing NO_X emissions.* [40 CFR 60.4333, A.A.C. R18-2-331.A.3.e]

   [Material permit conditions are indicated by underline and italics]

   b. *At all times when the gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall* maintain and *operate a Selective Catalytic Reduction (SCR) system in a manner consistent with consistent with manufacturer equipment operating guidelines and good air pollution control practices for minimizing NO_X emissions.* [40 CFR 60.4333, A.A.C. R18-2-331.A.3.e]

   [Material permit conditions are indicated by underline and italics]

3. Monitoring, Recordkeeping, and Reporting Requirements

   a. *At all times when the gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall install, certify, maintain,* and operate *Continuous Emission Monitoring Systems (CEMS) consisting of NO_X and O_2 (or CO_2) monitors to determine the hourly NO_X emission rate in parts per million from all four CTGs.*

   [40 CFR 60.4333, 40 CFR 60.4335(b)(1), A.A.C. R18-2-306.02.C, -306.A.3, -331.A.3.c]

   [Material permit conditions are indicated by underline and italics]

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b. *<u>At all times when the gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall install, calibrate, maintain</u>* and operate *<u>fuel flow meters to continuously measure the heat input to each gas turbine</u>*. The fuel flowmeters shall meet the installation, certification, and quality assurance requirements of appendix D to 40 CFR 75.

[40 CFR 60.4333, 40 CFR 60.4335(b)(2), 40 CFR 60.4345(c), A.A.C. R18-2-306.02.C, -306.A.3, -331.A.3.c]
[Material permit conditions are indicated by underline and italics]

c. For the NO_X and O_2 or CO_2 diluent CEMS, the Permittee shall meet all applicable requirements of 40 CFR Part 75, including but not limited to:

(1) 75.10 – General Operating Requirements;

(2) 75.12 – Specific Provisions for Monitoring NO_X Emission Rate;

(3) Subpart C – Operation and Maintenance Requirements;

(4) Subpart D – Missing Data Substitution Procedures;

(5) Subpart F – Recordkeeping Requirements;

(6) Subpart G – Reporting Requirements;

(7) Appendix A – Specifications and Test Procedures;

(8) Appendix B – Quality Assurance and Quality Control Procedures;

(9) Appendix C – Missing Data Estimation Procedures; and

(10) Appendix F – Conversion Procedures

The relative accuracy test audit (RATA) of the CEMS shall be performed on a lb/MMBtu basis.

[40 CFR 60.4345(a), A.A.C. R18-2-306.02.C, -306.A.3]

d. As specified in 40 CFR 60.13(e)(2), during each full unit operating hour, both the NO_x monitor and the diluent (O_2 or CO_2) monitor must complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each 15-minute quadrant of the hour, to validate the hour. For partial unit operating hours, at least one valid data point must be obtained for each quadrant of the hour in which the unit operates. For unit operating hours in which required quality assurance and maintenance activities are performed on the CEMS, a minimum of two valid data points (one in each of two quadrants) are required to validate the NOx emission rate for the hour. [40 CFR 60.4345(b)]

e. The Permittee shall implement quality assurance (QA) program and plan described in Section 1 of appendix B to 40 CFR 75 for all of the continuous monitoring equipment in paragraphs a and b above. [40 CFR 60.4345(e)]

f. For purposes of identifying excess emissions associated with Condition III.D.1.a above,

(1) All CEMS data must be reduced to hourly averages as specified in 40 CFR 60.13(h). [40 CFR 60.4350(a)]

(2) For each unit operating hour in which a valid hourly average, as described in Condition III.D.3.d above, is obtained for both NO_X and diluent, the data acquisition and handling system must calculate and record the hourly NO_X emissions in the units of ppm. [40 CFR 60.4350(b)]

(3) Only quality assured data shall be used to identify excess emissions. Periods where the missing data substitution procedures in subpart D of 40 CFR 75 are applied are to be reported as monitor downtime in the excess emissions and monitoring performance report required under Condition III.B.4 of this Attachment. [40 CFR 60.4350(d)]

(4) The Permittee shall use the calculated hourly average emission rates from (2) above to assess excess emissions on a 4-hour rolling average basis, as described in Condition III.D.3.g (1) below. [40 CFR 60.4350(f) and 40 CFR 60.4350(g)]

g. The Permittee shall submit reports of excess emissions and monitor downtime, in accordance with Condition III.B.4 of this Attachment. Excess emissions shall be reported for all periods of operation of gas turbines, including startup, shutdown and malfunction. Periods of excess emissions and monitor downtime that shall be reported are defined as follows: [40 CFR 60.4375(a)]

(1) An excess emissions shall be any unit operating period in which the 4-hour or 30-day rolling average NO_X emission rate exceeds the applicable emission limit in Condition III.D.1.a above. A "4-hour rolling average NO_X emission rate" is the arithmetic average of the average NO_X emission rate in ppm measured by the continuous emission monitoring equipment for a given hour and the three unit operating hour average NO_X emission rates immediately preceding that unit operating hour. Calculate the rolling average if a valid NO_X emission rate is obtained for at least 3 of the 4 hours. A "30-day rolling average NO_X emission rate" is the arithmetic average of all hourly NO_X emission data in ppm measured by the continuous emission monitoring equipment for a given day and the twenty-nine unit operating days immediately preceding that unit operating day. A new 30-day average is calculated each unit operating day as the average of all hourly NO_X emissions rates for the preceding 30 unit operating days if a valid NO_X emission rate is obtained for at least 75 percent of all operating hours. [40 CFR 60.4380(b)(1)]

(2) A period of monitor downtime is any unit operating hour in which the data for any of the following parameters are either missing or invalid: NO_X concentration, CO_2 or O_2 concentration, fuel flow rate or megawatts. [40 CFR 60.4380(b)(2)]

h. The Permittee shall determine and record the gross caloric value (GCV) of the pipeline quality natural gas at least once per month in accordance with the procedures in Section 2.3.4.1 or 2.3.4.2 of 40 CFR 75 Appendix D, as applicable. [A.A.C. R18-2-306.02.C, 306.A.3]

i. For demonstrating compliance with Condition III.D.1.b above, the Permittee shall utilize the NO_X and diluent CEMS required by Condition III.D.3.a in conjunction with the fuel flow rate monitoring systems required by Condition III.D.3.b and a Data Acquisition and Handling System (DAHS) to calculate mass emissions in units of pounds per million Btu (lb/MMBtu), pounds per hour (lb/hr), pounds per day, and tons per daily rolling 365-day total from all four (4) CTGs. [A.A.C. R18-2-306.02.C, -306.A.3]

(1) To calculate mass emissions in lb/MMBtu, the Permittee shall use the Procedures for NO_X Emission Rate in 40 CFR 75 Appendix F.

(2) The Permittee shall calculate mass emissions in lb/hr using the calculated lb/MMBtu rates, fuel flow monitoring data, and the GCV of the pipeline quality natural gas as determined under Condition III.D.3.h above.

j. During CEMS or fuel flow rate monitoring system downtime, the Permittee shall implement the missing data procedures in 40 CFR Part 75 Subpart D, Appendix C, and Appendix D, as applicable. [A.A.C. R18-2-306.02.C, 306.A.3]

k. Each calendar day during which total combined rolling 365-day total NOx emission rate from all four CTGs exceeds 39.0 tons shall constitute an exceedance of Condition III.D.1.b of this Attachment. Exceedances shall be reported to the Director in accordance with Condition XII.A of Attachment "A". [A.A.C. R18-2-306.02.C]

l. Each individual day and 365-day rolling total NO_X, emission rate in the reporting period shall be included in the semiannual compliance certification required by Condition VII of Attachment "A". [A.A.C. R18-2-306.02.C, -306.A.5]

4. Performance Testing Requirements

a. For each CTG, the Permittee shall perform an initial performance test for NO_X emissions within 60 days after achieving the maximum production rate at which the unit will be operated but not later than 180 days after initial startup. [40 CFR 60.8]

b. Each initial performance test for NO_X emissions shall be performed as follows. [40 CFR 60.8]

(1) Perform a minimum of nine RATA reference method runs, with a minimum time per run of 21 minutes, at a single load level, within plus or minus 25 percent of 100 percent of peak load. The ambient temperature must be greater than 0 °F during the RATA runs. [40 CFR 60.4405(a)]

(2) For each RATA run, concurrently measure the heat input to the unit using a fuel flow meter (or flow meters) and measure the electrical and thermal output from the unit. [40 CFR 60.4405(b)]

(3) Use the test data both to demonstrate compliance with the NO_X emission limit in Condition III.D.1.a of this Attachment and to provide the required reference method data for the RATA of the CEMS required by Conditions III.D.3.a and III.D.3.b above. [40 CFR 60.4405(c)]

(4) Compliance with the emission limit in Condition III.D.1.a of this Attachment is achieved if the arithmetic average of all of the NO_X emission rates for the RATA runs, expressed in units of ppm, does not exceed the emission limit. [40 CFR 60.4405(d)]

5. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with the following requirements as of the date of issuance of this permit: 40 CFR 60.4320(a),40 CFR 60.4333, 40 CFR 60.4335(b)(1), 40 CFR 60.4335(b)(2), 40 CFR 60.4345(a), 40 CFR 60.4345(b), 40 CFR 60.4345(c), 40 CFR 60.4345(e), 40 CFR 60.4350(a), 40 CFR 60.4350(b), 40 CFR 60.4350(c), 40 CFR 60.4350(d), 40 CFR 60.4350(g), 40 CFR 60.4375(a), 40 CFR 60.4380(b)(1), 40 CFR 60.4380(b)(2), and 40 CFR 60.4405.

[A.A.C. R18-2-325]

E. Sulfur Dioxide

1. Emission Limitations/Standards

a. The Permittee shall not burn in Combustion Turbine Generators (CTGs) any fuel that will emit SO_2 in excess of 0.060 pound/MMBtu of heat input.

[40 CFR 60.4330(a)(2)]

b. <u>*Total combined emissions of SO_2 from all the gas turbine units shall not exceed 36.0 tons per year on a rolling 12-month total.*</u>

[A.A.C. R18-2-306.01, -306.02, -331.A.3.a]

[Material permit conditions are indicated by underline and italics]

2. Performance Testing Requirements

a. The Permittee shall perform an initial performance test for SO_2 emissions from CTGs to demonstrate compliance with the emission limit contained in Condition III.E.1 above. The initial performance test shall be completed within 60 days after achieving the maximum production rate at which the unit will be operated, but not later than 180 days after initial startup. Subsequent performance test shall be conducted on annual basis (no more than 14 months following the previous performance test). [40 CFR 60.8, 40 CFR 60.4415(a)]

b. Performance tests shall be conducted in accordance with 40 CFR 60.8 and using the methodologies in 40 CFR 4415(a). [40 CFR 60.8, 40 CFR 60.4415(a)]

c. The Permittee shall record and report the results of each performance test for SO_2 emissions in units of lb/MMBtu heat input. [A.A.C. R18-2-306.A.3.c]

3. Monitoring, Recordkeeping, and Reporting Requirements

a. The Permittee shall demonstrate compliance with emission standard in III.E.1.a above by maintaining a current, valid purchase contract, tariff sheet, or transportation contract specifying that the maximum total sulfur content of the natural gas is 20 grains/100 scf or less. [40 CFR 60.4365(a)]

b. The Permittee shall demonstrate compliance with emission standard in III.E.1.b as follows:

Within 10 days after the end of each calendar month, the Permittee shall calculate and record rolling 12-month SO_2 emissions from all four CTGs. The SO_2 emission rate shall be calculated as the product of the SO_2 emission factor determined in accordance with Condition III.E.2.c from the most recent performance test and the heat input rate for the 12-month period, as determined in accordance with Condition III.D.i of this Attachment. [A.A.C. R18-2-306.A.3.c]

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3. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with 40 CFR 60. 40 CFR 60.4330(a)(2), 40 CFR 60.4365(a), 40 CFR 60.4415(a). [A.A.C. R18-2-325]

F. Carbon Monoxide

1. Emission Limitations/Standards

Total combined emissions of CO from all four CTGs shall not exceed 90.0 tons per year, calculated daily as a rolling 365-day total. [A.A.C. R18-2-306.01, -306.02.A, -331.A.3.a]

[Material permit conditions are indicated by underline and italics]

2. Air Pollution Control Equipment

<u>*At all times when the gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall, to the extent practicable,*</u> <u>*maintain*</u> and <u>*operate the oxidation catalyst system in a manner consistent with consistent with manufacturer equipment operating guidelines and good air pollution control practices for minimizing CO emissions.*</u> [40 CFR 60.11(d), A.A.C. R18-2-331.A.3.e]

[Material permit conditions are indicated by underline and italics]

3. Monitoring, Recordkeeping, and Reporting Requirements

a. <u>*At all times when the gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall install, certify, maintain*</u>, operate and <u>*quality-assure Continuous Emission Monitoring Systems (CEMS) consisting of CO and O_2 (or CO_2) monitors for measuring CO emissions from CTGs.*</u>
[A.A.C. R18-2-306.02.C, -306.A.3, -331.A.3.c]
[Material permit conditions are indicated by underline and italics]

b. The CO CEMS shall meet all applicable requirements of 40 CFR Part 60, including but not limited to the following: [A.A.C. R18-2-306.02.C, -306.A.3]

(1) 60.13 – Monitoring Requirements;

(2) Appendix B – Performance Specification 4A; and

(3) Appendix F – Quality Assurance Procedures.

c. For demonstrating compliance with Condition III.F.1, the Permittee shall utilize the CO and diluent CEMS required by Condition III.F.3.a in conjunction with the fuel flow rate monitoring systems required by Condition III.D.3.b and a Data Acquisition and Handling System (DAHS) to calculate mass emissions in units of pounds per million Btu (lb/MMBtu), pounds per hour (lb/hr), pounds per day, and tons per daily rolling 365-day total from all the CTGs.
[A.A.C. R18-2-306.02.C, -306.A.3]

(1) To calculate mass emissions in lb/MMBtu, the Permittee shall use the Procedures for NO_X Emission Rate in 40 CFR 75 Appendix F. For CO, the value of K in Equations F-5 and F-6 = 7.266×10^{-8} (lb/dscf)/ppm CO.

(2) The Permittee shall calculate mass emissions in lb/hr using the calculated lb/MMBtu rates, fuel flow monitoring data, and the GCV of the pipeline

quality natural gas as determined under Condition III.D.3.h of this Attachment.

d. During CEMS or fuel flow rate monitoring system downtime, the Permittee shall implement the missing data procedures in 40 CFR Part 75 Subpart D, Appendix C, and Appendix D, as applicable. For CO monitoring data, the Permittee shall use the missing data estimation and substitution procedures prescribed for NO_X.
[A.A.C. R18-2-306.02.C, -306.A.3]

e. Each calendar day during which total combined rolling 365-day total CO emission rate from all the CTGs exceeds 90.0 tons shall constitute an exceedance of Condition III.F.1. Exceedances shall be reported to the Director in accordance with Condition XII.A of Attachment "A". [A.A.C. R18-2-306.02.C]

f. Each individual day and 365-day rolling total CO emission rate in the reporting period shall be included in the semiannual compliance certification required by Condition VII of Attachment "A". [A.A.C. R18-2-306.02.C, -306.A.5]

G. Particulate Matter

1. Emission Limitations/Standards

Total combined emissions of PM_{10} from all four CTGs shall not exceed 14.0 tons per year on a rolling 12-month total. [A.A.C R18-2-306.01.A, A.A.C R18-2-331.A.3.a]
[Material permit conditions are indicated by underline and italics]

2. Performance Testing Requirements

a. For each CTG, the Permittee shall perform an initial performance test for PM_{10} emissions within 60 days after achieving 300 fired hours on the CTG. Subsequent performance test shall be conducted annually. If at the end of any month, the 12-month rolling total of PM_{10} emissions for the 4 CTGs exceeds 13.5 tons, the test frequency will change to semi-annual. [A.A.C. R18-2-312]

b. Each performance test for PM_{10} emissions shall be performed using EPA Methods 5 and EPA Method 202. [A.A.C. R18-2-312]

c. The Permittee shall record and report the results of each performance test for PM_{10} emissions in units of lb/MMBtu heat input. [A.A.C. R18-2-306.A.3.c]

3. Monitoring, Recordkeeping, and Reporting Requirements

Within 10 days after the end of each calendar month, the Permittee shall calculate and record rolling 12-month PM_{10} emissions from all four CTGs. The PM_{10} emission rate shall be calculated as the product of the PM_{10} emission factor determined in accordance with Condition III.G.2.c from the most recent performance test and the heat input rate for the 12-month period, determined in accordance with Condition III.D.i of this Attachment.
[A.A.C. R18-2-306.A.3.c]

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H. Volatile Organic Compounds (VOCs)

1. Emission Limitations/Standards

<u>*Total combined emissions of VOCs from all four CTGs not exceed 36.0 tons per year, on a rolling 12-month total.*</u> [A.A.C. R18-2-306.01, -306.02.A, -331.A.3.a]

[Material permit conditions are indicated by underline and italics]

2. Air Pollution Control Equipment

<u>*At all times when gas turbines are in operation, including during startup, shutdown, and malfunction, the Permittee shall, to the extent practicable,*</u> maintain and <u>*operate the oxidation catalyst system in a manner consistent with manufacturer equipment operating guidelines and good air pollution control practices for minimizing CO emissions.*</u>

[40 CFR 60.11(d), A.A.C. R18-2-331.A.3.e]

[Material permit conditions are indicated by underline and italics]

3. Performance Testing Requirements

   a. For each CTG, the Permittee shall perform an initial performance test for VOC emissions within 60 days after achieving 300 fired hours on the CTG. Subsequent performance test shall be performed annually. [A.A.C. R18-2-312]

   b. Each performance test for VOC emissions shall be performed using EPA Methods 25A/25B. [A.A.C. R18-2-312]

   c. The Permittee shall record and report the results of each performance test for VOC emissions in units of lb/MMBtu heat input. [A.A.C. R18-2-306.A.3.c]

4. Monitoring, Recordkeeping, and Reporting Requirements

Within 10 days after the end of each calendar month, the Permittee shall calculate and record rolling 12-month VOC emissions from all four CTGs. The VOC emission rate shall be calculated as the product of the VOC emission factor determined in accordance with Condition III.H.3.c from the most recent performance test and the heat input rate for the 12-month period, determined in accordance with Condition III.D.i of this Attachment.

[A.A.C. R18-2-306.A.3.c]

I. Ammonia

1. Emission Standards

The Permittee shall not allow the emissions of ammonia (slippage) from each CTG to exceed 10 ppmvd corrected to 15% O_2. [A.A.C. R18-2-306.A.2]

2. Testing Requirements

Within 180 days of initial startup, and annually thereafter, the Permittee shall conduct a performance test for ammonia slippage using methods approved by the Director.

[A.A.C. R18-2-312]

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IV. AIR CHILLER SYSTEM/AMMONIA STORAGE

A. Applicability

This section applies to the air chilling system serving CTGs and ammonia storage tank.

B. Particulate Matter and Opacity

1. Emission Limitations/Standards

   a. The Permittee shall not emit or cause to be emitted into the atmosphere particulate matter in excess of the allowable hourly emission rate determined as follows:

      i. Determination of the allowable emission rates (E) for process weight rates up to 60,000 lb/hr shall be accomplished by use of the equation: [A.A.C. R18-2-730.A.1.a]

      $E = 4.10P^{0.67}$

      Where:

      E = the maximum allowable particulate emissions rate in pounds-mass per hour; and

      P = the process weight rate in tons-mass per hour.

      ii. Determination of the allowable emission rates (E) for process weight rates in excess of 60,000 lb/hr shall be accomplished by use of the equation: [A.A.C. R18-2-730.A.1.b]

      $E = 55.0P^{0.11} - 40$

      Where:

      E = the maximum allowable particulate emissions rate in pounds-mass per hour; and

      P = the process weight rate in tons-mass per hour.

   b. The Permittee shall not cause, allow or permit to be emitted into the atmosphere any plume or effluent the opacity of which exceeds 20 percent, measured in accordance with Reference Method 9 in 40 CFR 60, Appendix A . [A.A.C.R18-2-702.B]

   c. If the presence of uncombined water is the only reason for an exceedance of the applicable opacity requirement, the exceedance shall not constitute a violation of the applicable opacity limit. [A.A.C.R18-2-702.C]

   d. The Permittee shall not emit gaseous or odorous materials from equipment, operations or premises under his control in such quantities or concentrations as to cause air pollution. [A.A.C. R18-2-730.D]

   e. Materials including solvents or other volatile compounds, paints, acids, alkalies, pesticides, fertilizers and manure shall be processed, stored, used, and transported in such a manner and by means that they will not evaporate, leak, escape or be otherwise discharged into the ambient air so as to cause or contribute to air pollution. Where means are available to reduce effectively the contribution to air pollution from evaporation, leakage or discharge, the installation and use of such control methods, devices, or equipment shall be mandatory. [A.A.C. R18-2-730.F]

f. Where a stack, vent, or other outlet is at such a level that fumes, gas mist, odor, smoke, vapor or any combination thereof constituting air pollution is discharged to adjoining property, the Director may require the installation of abatement equipment or the alteration of such stack, vent, or other outlet by the Permittee thereof to a degree that will adequately dilute, reduce, or eliminate the discharge of air pollution to adjoining property. [A.A.C.R18-2-730.G]

2. Monitoring, Recordkeeping, and Reporting

A certified EPA Reference Method 9 observer shall conduct a monthly survey of visible emissions emanating from the chiller system. If the opacity of the emissions observed appears to exceed the standard, the observer shall conduct a certified EPA Reference Method 9 observation. The Permittee shall keep records of the initial survey and any EPA Reference Method 9 observations performed. These records shall include the emission point observed, name of observer, date and time of observation, and the results of the observation. [A.A.C.R18-2-306.A.3.c]

3. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with A.A.C. R18-2-702.B, A.A.C. R18-2-702.C, A.A.C. R18-2-730.A.1, A.A.C. R18-2-730.D, A.A.C. R18-2-730.F, and A.A.C. R18-2-730.G. [A.A.C.R18-2-325]

V. FUGITIVE DUST REQUIREMENTS

A. Applicability

This Section applies to any source of fugitive dust in the facility.

B. Particulate Matter and Opacity

1. Open Areas, Roadways & Streets, Storage Piles, and Material Handling

a. Emission Limitations/Standards

i. Opacity of emissions from any fugitive dust source shall not be greater than 40% measured in accordance with the Arizona Testing Manual, Reference Method 9. [A.A.C. R18-2-614]

ii. The Permittee shall not cause, allow or permit visible emissions from any point source, in excess of 20 percent opacity. [A.A.C-R18-2-702.B]

iii. The Permittee shall employ the following reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne:

(a) Keep dust and other types of air contaminants to a minimum in an open area where construction operations, repair operations, demolition activities, clearing operations, leveling operations, or any earth moving or excavating activities are taking place, by good modern practices such as using an approved dust suppressant or adhesive soil stabilizer, paving, covering, landscaping, continuous wetting, detouring, barring access, or other acceptable means; [A.A.C. R18-2-604.A]

(b) Keep dust to a minimum from driveways, parking areas, and vacant lots where motor vehicular activity occurs by using an approved dust suppressant, or adhesive soil stabilizer, or by paving, or by barring access to the property, or by other acceptable means; [A.A.C. R18-2-604.B]

(c) Keep dust and other particulates to a minimum by employing dust suppressants, temporary paving, detouring, wetting down or by other reasonable means when a roadway is repaired, constructed, or reconstructed; [A.A.C. R18-2-605.A]

(d) Take reasonable precautions, such as wetting, applying dust suppressants, or covering the load when transporting material likely to give rise to airborne dust; [A.A.C. R18-2-605.B]

(e) Take reasonable precautions, such as the use of spray bars, wetting agents, dust suppressants, covering the load, and hoods when crushing, handling, or conveying material likely to give rise to airborne dust; [A.A.C. R18-2-606]

(f) Take reasonable precautions such as chemical stabilization, wetting, or covering when organic or inorganic dust producing material is being stacked, piled, or otherwise stored; [A.A.C. R18-2-607.A]

(g) Operate stacking and reclaiming machinery utilized at storage piles at all times with a minimum fall of material, or with the use of spray bars and wetting agents; [A.A.C. R18-2-607.B]

(h) Any other method as proposed by the Permittee and approved by the Director. [A.A.C. R18-2-306.A.3.c]

b. Monitoring and Recordkeeping Requirements

i. The Permittee shall maintain records of the dates on which any of the activities listed in Conditions V.B.1.a.iii.(a) through V.B.1.a.iii(h) above were performed and the control measures that were adopted. [A.A.C. R18-2-306.A.3.c]

ii. Opacity Monitoring Requirements

(a) A certified Method 9 observer shall conduct a monthly visual survey of visible emissions from the fugitive dust sources. The Permittee shall keep a record of the name of the observer, the date and location on which the observation was made, and the results of the observation.

(b) If the observer sees a visible emission from a fugitive dust source that on an instantaneous basis appears to exceed applicable opacity standard, then the observer shall, if practicable, take a six-minute Method 9 observation of the visible emission.

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(1) If the six-minute opacity of the visible emission is less than or equal to applicable opacity standard, the observer shall make a record of the following:

a) Location, date, and time of the observation; and

b) The results of the Method 9 observation.

(2). If the six-minute opacity of the visible emission exceeds applicable opacity standard, then the Permittee shall do the following:

a) Adjust or repair the controls or equipment to reduce opacity to below the applicable standard; and

b) Report it as an excess emission under Section XII.A of Attachment "A".

[A.A.C. R18-2-306.A.3.c]

c. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with A.A.C. R18-2-604.A, A.A.C. R18-2-604.B, A.A.C. R18-2-605, A.A.C. R18-2-606, A.A.C. R18-2-607, and A.A.C. R18-2-612. [A.A.C. R18-2-325]

2. Open Burning

a. Emission Limitation/Standard

Except as provided in A.A.C. R18-2-602.C.1, C.2, C.3, and C.4, and except when permitted to do so by either ADEQ or the local officer delegated the authority for issuance of open burning permits, the Permittee shall not conduct open burning.

[A.A.C. R18-2-602]

b. Monitoring and Recordkeeping Requirement

Compliance with the requirements of Condition V.B.2.a above may be demonstrated by maintaining copies of all open burning permits on file.

[A.A.C. R18-2-306.A.3.c]

c. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with A.A.C. R18-2-602. [A.A.C. R18-2-325]

VI. MOBILE SOURCE REQUIREMENTS

A. Applicability

The requirements of this Section are applicable to mobile sources which either move while emitting air contaminants or are frequently moved during the course of their utilization but are not classified as motor vehicles, agricultural vehicles, or are agricultural equipment used in normal farm operations. Mobile sources shall not include portable sources as defined in A.A.C. R18-2-101.90. [A.A.C.R18-2-801.A]

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B. Particulate Matter and Opacity

1. Emission Limitations/Standards

a. Off-Road Machinery

The Permittee shall not cause, allow, or permit to be emitted into the atmosphere from any off-road machinery, smoke for any period greater than ten consecutive seconds, the opacity of which exceeds 40%. Visible emissions when starting cold equipment shall be exempt from this requirement for the first ten minutes. Off-road machinery shall include trucks, graders, scrapers, rollers, and other construction and mining machinery not normally driven on a completed public roadway. [A.A.C.R18-2-802.A and -802.B]

b. Roadway and Site Cleaning Machinery

i. The Permittee shall not cause, allow or permit to be emitted into the atmosphere from any roadway and site cleaning machinery smoke or dust for any period greater than ten consecutive seconds, the opacity of which exceeds 40%. Visible emissions when starting cold equipment shall be exempt from this requirement for the first ten minutes. [A.A.C.R18-2-804.A]

ii. The Permittee shall take reasonable precautions, such as the use of dust suppressants, before the cleaning of a site, roadway, or alley. Earth or other material shall be removed from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water or by other means. [A.A.C. R18-2-804.B]

iii. Unless otherwise specified, no mobile source shall emit smoke or dust the opacity of which exceeds 40%. [A.A.C.R18-2-801.B]

2. Recordkeeping Requirement

The Permittee shall keep a record of all emissions related maintenance activities performed on the Permittee's mobile sources stationed at the facility as per manufacturer's specifications. [A.A.C.R18-2-306.A.5.a]

3. Permit Shield

Compliance with this Section shall be deemed compliance with A.A.C. R18-2-801, A.A.C. R18-2-802.A, A.A.C. R18-2-804.A and A.A.C. R18-2-804.B. [A.A.C.R18-2-325]

VII. OTHER PERIODIC ACTIVITY REQUIREMENTS

A. Abrasive Blasting

Particulate Matter and Opacity

1. Emission Limitations/Standards

a. The Permittee shall not cause or allow sandblasting or other abrasive blasting without minimizing dust emissions to the atmosphere through the use of good modern practices. Good modern practices include:

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i. wet blasting;

ii. effective enclosures with necessary dust collecting equipment; or

iii. any other method approved by the Director.

[A.A.C. R18-2-726]

b. Opacity

The Permittee shall not cause, allow or permit visible emissions from sandblasting or other abrasive blasting operations in excess of 20% opacity, as measured by EPA Reference Method 9. [A.A.C. R18-2-702.B]

2. Monitoring and Recordkeeping Requirement

Each time an abrasive blasting project is conducted, the Permittee shall log in ink or in an electronic format, a record of the following:

a. The date the project was conducted;

b. The duration of the project; and

c. Type of control measures employed.

[A.A.C. R18-2-306.A.3.c]

3. Permit Shield

Compliance with this Part shall be deemed compliance with A.A.C. R18-2-726, A.A.C. R18-2-702.B. [A.A.C.R18-2-325]

B. Use of Paints

1. Volatile Organic Compounds

a. Emission Limitations/Standards

While performing spray painting operations, the Permittee shall comply with the following requirements:

i. The Permittee shall not conduct or cause to be conducted any spray painting operation without minimizing organic solvent emissions. Such operations, other than architectural coating and spot painting, shall be conducted in an enclosed area equipped with controls containing no less than 96 percent of the overspray. [A.A.C.R18-2-727.A]

ii. The Permittee or their designated contractor shall not either:

(a) Employ, apply, evaporate, or dry any architectural coating containing photochemically reactive solvents for industrial or commercial purposes; or

(b) Thin or dilute any architectural coating with a photochemically reactive solvent.

[A.A.C.R18-2-727.B]

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iii. For the purposes of Conditions VII.B.1.a.ii and VII.B.1.a.v, a photochemically reactive solvent shall be any solvent with an aggregate of more than 20 percent of its total volume composed of the chemical compounds classified in Conditions VIII.B.1.a.iii(a) through VIII.B.1.a.iii(c) below, or which exceeds any of the following percentage composition limitations, referred to the total volume of solvent:

(a) A combination of the following types of compounds having an olefinic or cyclo-olefinic type of unsaturation-hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones: 5 percent.

(b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent.

(c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent.
[A.A.C.R18-2-727.C]

iv. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the groups of organic compounds described in Conditions VII.B.1.a.iii(a) through VII.B.1.a.iii(c) above, it shall be considered to be a member of the group having the least allowable percent of the total volume of solvents. [A.A.C.R18-2-727.D]

v. The Permittee shall not dispose of by evaporation more than 1.5 gallons of photochemically reactive solvent in any one day.
[SIP Provision R9-3-527.C]

b. Monitoring and Recordkeeping Requirements

i. Each time a spray painting project is conducted, the Permittee shall log in ink, or in an electronic format, a record of the following:

(a) The date the project was conducted;

(b) The duration of the project;

(c) Type of control measures employed;

(d) Material Safety Data Sheets for all paints and solvents used in the project; and

(e) The amount of paint consumed during the project.

ii. Architectural coating and spot painting projects shall be exempt from the recordkeeping requirements of Condition VII.B.1.b.i above.
[A.A.C. R18-2-306.A.3.c]

c. Permit Shield

Compliance with this Part shall be deemed compliance with A.A.C.R18-2-727 and SIP Provision R9-3-527.C. [A.A.C.R18-2-325]

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2. Opacity

a. Emission Limitation/Standard

The Permittee shall not cause, allow or permit visible emissions from painting operations in excess of 20% opacity, as measured by EPA Reference Method 9.
[A.A.C. R18-2-702.B]

b. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with A.A.C.R18-2-702.B. [A.A.C. R18-2-325]

C. Demolition/Renovation - Hazardous Air Pollutants

1. Emission Limitation/Standard

The Permittee shall comply with all of the requirements of 40 CFR 61 Subpart M (National Emissions Standards for Hazardous Air Pollutants - Asbestos).
[A.A.C. R18-2-1101.A.8]

2. Monitoring and Recordkeeping Requirement

The Permittee shall keep all required records in a file. The required records shall include the "NESHAP Notification for Renovation and Demolition Activities" form and all supporting documents. [A.A.C. R18-2-306.A.3.c]

3. Permit Shield

Compliance with the conditions of this Part shall be deemed compliance with A.A.C. R18-2-1101.A.8. [A.A.C. R18-2-325]

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ATTACHMENT "C": EQUIPMENT LIST

Air Quality Control Permit No. 43801
for
Northern Arizona Energy, LLC

NAME	CAPACITY	MAKE	MODEL	SERIAL NUMBER	DATE OF MANUFACTURE	EQUIPMENT NUMBER
Combustion Gas Turbine 1*	48 MW	General Electric	LM6000PC-Sprint Nxgen	TBD	TBD	CT1
Combustion Gas Turbine 2*	48 MW	General Electric	LM6000PC-Sprint Nxgen	TBD	TBD	CT2
Combustion Gas Turbine 3*	48 MW	General Electric	LM6000PC-Sprint Nxgen	TBD	TBD	CT3
Combustion Gas Turbine 4*	48 MW	General Electric	LM6000PC-Sprint Nxgen	TBD	TBD	CT4
Chiller System for Combustion Turbines	345 gallons per minute Recirculation rate	TBD	TBD	TBD	TBD	Chiller
Aqueous Ammonia Storage Tank	10000 gallons	TBD	TBD	TBD	TBD	TBD

* Each turbine is equipped with selective catalytic reduction system (SCR), and oxidation catalyst unit.

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ATTACHMENT "D": PHASE II ACID RAIN PROVISIONS
Air Quality Control Permit No. 43801
for
Northern Arizona Energy, LLC

I. Statement of Basis

Statutory and Regulatory Authorities: In accordance with Arizona Revised Statutes, Title 49, Chapter 3, Article 2, Section 426.N, and Titles IV and V of the Clean Air Act, the Arizona Department of Environmental Quality issues this Phase II Acid Rain Permit pursuant to Arizona Administrative Code, Title 18, Chapter 2, Article 3, Section 333 (A.A.C. R18-2-333), "Acid Rain."

II. SO_2 Allowance* Allocations and NO_X Requirements for each Affected Unit

A. The Permittee shall comply with the Acid Rain Permit and 40 CFR Parts 72, 73, and 75.

B. The Permittee shall hold SO_2 allowances as of the allowance transfer deadline in each Gas Turbine Unit compliance sub-account not less than the total annual actual emissions of SO_2 from each gas turbine unit for the previous calendar year as required by the Acid Rain Program.

C. The SO_2 Allowance Requirements and NO_X requirements for CT1, CT2, CT3 and CT4 are as follows:

CT1

Year:	2007-2012
Annual SO_2 allowances	NA
NOx Limits:	This Unit is not subject to a NO_X limit under 40 CFR Part 76.

CT2

Year:	2007-2012
Annual SO_2 allowances	NA
NOx Limits:	This Unit is not subject to a NO_X limit under 40 CFR Part 76.

CT3

Year:	2007-2012
Annual SO_2 allowances	NA
NOx Limits:	This Unit is not subject to a NO_X limit under 40 CFR Part 76.

CT4

Year:	2007-2012
Annual SO_2 allowances	NA
NOx Limits:	This Unit is not subject to a NO_X limit under 40 CFR Part 76.

*As defined under 40 CFR §72.2, "Allowance" means an authorization by the Administrator under the Acid Rain Program to emit up to one ton of sulfur dioxide during or after a specified calendar year.

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III. Permit Application

The Permittee, and any other owners or operators of the affected units at this facility, shall comply with the requirements contained in the Acid Rain Permit Application signed by the Designated Representative on March 23, 2007.

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TECHNICAL SUPPORT DOCUMENT
FOR
NORTHERN ARIZONA ENERGY, LLC
AIR QUALITY PERMIT NO. 43801

I. INTRODUCTION

Northern Arizona Energy, LLC, the Permittee, has proposed to construct and operate a gas-fired peaking power generation plant, consisting of four (4) combustion turbine generators (CTG) of 48 MW each. The facility will be located approximately 3 miles north of the Griffith Interchange on Interstate 40 in Mohave County, Arizona. The project will interconnect with the Western Area Power Administration (WAPA) transmission system at the Griffith Switchyard. The project is designed to serve peak load requirements of customers in Mohave county and surrounding regional load centers.

A. Company Information

1. Facility Name

   Northern Arizona Energy Project

2. Mailing Address

   Northern Arizona Energy, LLC
   1735 Technology Drive Suite 820
   San Jose, CA 95110

3. Facility Address

   Apache and Haul Road
   Golden Valley, AZ 86413
   Approximately 3 miles north of the I-40 Griffith Interchange in Mohave County, Arizona.

B. Attainment Classification

The project will be located in Mohave County, which is designated as attainment or unclassifiable for all criteria air pollutants.

C. Learning Sites

The facility has no learning sites located within 2 miles.

II. FACILITY DESCRIPTION

A. Process Description

The Northern Arizona Energy, LLC (NAE) has proposed to construct the project in a phased manner, and at full capacity, the project will have four (4) combustion turbine generators (CTG) of 48 MW each. The CTGs will be fired exclusively on natural gas. A chiller system will be utilized to cool the incoming air to improve turbine efficiency and preserve peaking output during the hottest ambient temperature days. Other auxiliary equipment includes air filter, chiller coils, water treatment equipment, natural gas compressors, transformers and water storage tanks. Each CTG will also be equipped with a SPRINT (SPRay INTercooling) system to enhance turbine efficiency and power output.

B. Air Pollution Control Equipment

The CTGs will have a water injection system to control nitrogen oxide (NO_X) emissions. In addition, a selective catalytic reduction (SCR) system will be used to further reduce NOx emissions. Also, an oxidation catalyst will be used to reduce carbon monoxide (CO) and volatile organic compound (VOC) emissions. The water chiller system will be equipped with a drift eliminator.

III. EMISSIONS

A. Potential Annual Emissions

The project is owned by NAE. NAE is owned by an entity that is jointly owned by LS Power Corporation and Dynegy Corporation. Griffith Energy is also owned by Dynegy. Due to common management of NAE and Griffith Energy (operating under a Class I Title V permit), and location on contiguous property, the operations at NAE and Griffith Energy have been evaluated as a single "stationary source". Consequently, NAE operations are also being covered by a Class I Title V Permit. Potential emissions of nitrogen oxides (NO_X), sulfur dioxide (SO_2), and particulate matter less than 10 microns (PM_{10}), carbon monoxide (CO), and volatile organic compounds (VOCs) each exceed the significant threshold. However, total allowable NO_X, SO_2, CO, VOCs, and PM_{10} emissions are limited by enforceable permit conditions to less than the significant level. Thus, the NAE operations will not be subject to New Source Review (NSR). Combined potential emissions of hazardous air pollutants (HAP) for NAE and Griffith Energy are below 10 and 25 tpy for individual and total combined HAP, respectively. Therefore, the facility is not a major source of HAP emissions for the purposes of CAA Section 112 and Article 11 of A.A.C. title 18, chapter 2.

The following emission limits are specified in the permit:

TABLE 1: Emission Limits

Pollutant	Significant Threshold Tons/year	Emission Limits for 4 CTGs Tons/year
NO_X	40.0	39.0
CO	100.0	90.0
PM_{10}	15.0	14.0
VOCs	40.0	36.0
SO_2	40.0	36.0

1. Particulate Matter

The PM_{10} emissions from the proposed project include emissions from the new combustion turbines and chiller system.

a. Combustion Turbines

The maximum allowable PM_{10} emissions from the 4 CTGs collectively are limited to 14.0 tons per year. Compliance with this limit is to be demonstrated through use of continuous fuel flow monitoring in conjunction with unit-specific emission factors based on performance testing. Total PM_{10} emissions from the 4 CTGs are to be calculated and recorded monthly, based on a 12-month rolling sum.

b. Cooling Tower

The potential PM_{10} emissions from the cooling tower are expected to be 0.47 tons per year, based on 6000 hours of operation (chiller will be operated only when ambient temperature is more than 60° F), and 345 gallons per minute recirculation rate.

2. Nitrogen Oxides

The maximum allowable NO_X emissions from the 4 CTGs collectively are limited to 39.0 tons per year. Compliance with this limit is to be demonstrated through use of a continuous emission rate monitoring system, with total NO_X emissions from the 4 CTGs to be calculated and recorded daily, based on a 365-day rolling sum.

3. Carbon Monoxide

The maximum allowable CO emissions from the 4 CTGs collectively are limited to 90.0 tons per year. Compliance with this limit is to be demonstrated through use of a continuous emission rate monitoring system, with total CO emissions from the 4 CTGs to be calculated and recorded daily, based on a 365-day rolling sum.

4. Sulfur Dioxide (SO_2)

The maximum allowable SO_2 emissions from the 4 CTGs collectively are limited to 36.0 tons per year. Compliance with this limit is to be demonstrated through use of continuous fuel flow monitoring in conjunction with unit-specific emission factors based on performance testing. Total SO_2 emissions from the 4 CTGs are to be calculated and recorded monthly, based on a 12-month rolling sum.

5. Volatile Organic Compounds (VOCs)

The maximum allowable VOCs emissions from the 4 CTGs collectively are limited to 36.0 tons per year. Compliance with this limit is to be demonstrated through use of continuous fuel flow monitoring in conjunction with unit-specific emission factors based on performance testing. Total VOC emissions from the 4 CTGs are to be calculated and recorded monthly, based on a 12-month rolling sum.

IV. APPLICABLE REGULATIONS

Section 5 of the NAE permit application presented a regulatory analysis and generally identified Federal and State air quality regulations applicable to the proposed source and emission units. Table 2 summarizes the findings of the Department with respect to the applicability or non-applicability of specific regulations to emission units and emission unit groups.

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TABLE 2: REGULATORY ANALYSIS

Unit ID	Construction Date	Control Device	Regulation(s)	Applicable? (Y/N)	Verification
Gas Turbines CT1, CT2, CT3, CT4	2007	Selective Catalytic Reduction and Oxidation Catalyst	NSPS Gen. Provisions A.A.C R18-2-901(1) 40 CFR 60 subpart A	Y	Units are subject to an NSPS rule. See below.
			NSPS Subpart KKKK 40 CFR § 60.4305	Y	Each combustion turbine has heat input greater than 10 million Btu per hour and will be constructed after 2/18/2005.
			NSPS Subpart KKKK 40 CFR § 60.4320	Y	Each combustion turbine is subject to NO_X standards for gas-fired units with heat input equal to or greater than 10 million Btu per hour and less than 850 million Btu per hour.
			NSPS Subpart KKKK 40 CFR § 60.4330	Y	Each combustion turbine is subject to SO_2 standards for units located in the continental U.S.
			NSPS Subpart KKKK 40 CFR § 60.4335, 40 CFR § 60.4345, 40 CFR § 60.4350	Y	Each combustion turbine is subject to NO_X monitoring requirements for units equipped with water injection. Permittee has elected to use continuous emissions monitoring systems.
			NSPS Subpart KKKK 40 CFR § 60.4365	Y	Each combustion turbine is subject to SO_2 monitoring and recordkeeping requirements. Permittee has elected to maintain records of fuel specifications from tariff or contract.
			NSPS Subpart KKKK 40 CFR § 60.4375 40 CFR § 60.4380	Y	Each combustion turbine is subject to NO_X reporting requirements. Permittee has elected to use continuous emissions monitoring systems.

			NSPS Subpart KKKK 40 CFR § 60.4405	Y	Each combustion turbine is subject to NO_X performance testing requirements. Permittee has elected to use continuous emissions monitoring systems.
			NSPS Subpart KKKK 40 CFR § 60.4415	Y	Each combustion turbine is subject to SO_2 performance testing requirements.
			NSPS Subpart GG A.A.C R18-2-901(40)	Y	Each combustion turbine was constructed after October 3, 1977 and has a heat input at peak load greater than 10.7 gigajoules per hour. NSPS subpart KKKK includes an exemption from complying with the provisions of subpart GG, but this exemption does not extend to A.A.C R18-2-901(40) until such time as subpart KKKK is incorporated into the A.A.C. The requirements of subpart GG are applicable, but have been incorporated into the permit only by reference, as the exemption is expected to take effect prior to startup of these combustion turbines.
			Acid Rain Program A.A.C. R18-2-333 40 CFR 72 – 78	Y	Each combustion turbine is a utility unit.
			NESHAP Subpart YYYY	N	40 CFR 63 Subpart YYYY applies to stationary combustion turbines located at major sources of HAP emissions. NAE is an area (i.e., non-major) source of HAP.
			PSD A.A.C. R18-2-406 A.A.C. R18-2-407	N	Permittee has voluntarily accepted limitations on criteria pollutant emissions to ensure that the project will not result in a significant net emissions increase.
			Compliance Assurance Monitoring 40 CFR 64	N	Each combustion turbine uses a control device only for NO_X and CO emissions. For each of these pollutants, the permit specifies use of CEMS as "a continuous compliance determination method". Therefore, CAM is not applicable.

Chiller system and aqueous ammonia storage	2007	Drift Eliminator	A.A.C R18-2-702(B)	Y	Unit is subject to the generally applicable opacity emission standard because it is not subject to any other opacity standard.
			A.A.C R18-2-730	Y	Unit is subject to the generally applicable emission standard and conditions as these are unclassified process sources

V. MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

A. Combustion Gas Turbines

1. NSPS Requirements

As shown in Table 2, each combustion turbine is subject to the NO_X and SO_2 emission standards and the accompanying monitoring, recordkeeping, and reporting requirements under 40 CFR 60 subpart KKKK. These provisions include a requirement to operate a continuous emission monitoring system for NO_X emissions, and to maintain records of current valid natural gas purchase contract, specifying maximum total sulfur content to demonstrate compliance with sulfur limit.

2. Fuel Restriction

Each combustion turbine is permitted to burn only pipeline quality natural gas.

3. Synthetic Minor NO_X and CO Emission Limits

The Permittee has voluntarily accepted enforceable emission limits that will ensure that the proposed project will not result in a significant net emissions increase that would trigger PSD applicability. The Permittee is required to use continuous emission rate monitoring systems to demonstrate continuous compliance with these limits.

4. Synthetic Minor PM_{10} Emission Limit

The Permittee has voluntarily accepted an enforceable emission limit that will ensure that the proposed project will not result in a significant net emissions increase that would trigger NSR applicability. The Permittee is required to use continuous fuel flow monitoring systems, in conjunction with performance test results, in order to demonstrate continuous compliance with this limit. For calculating emissions, the most recent performance test results shall be used to calculate emissions.

5. Synthetic Minor SO_2 and VOC Emission Limits

The Permittee has voluntarily accepted enforceable emission limits that will ensure that the proposed project will not result in a significant net emissions increase that would trigger NSR applicability. The Permittee is required to use continuous fuel flow monitoring systems, in conjunction with performance test results, in order to demonstrate continuous compliance with this limit. For calculating emissions, the most recent performance test results shall be used to calculate emissions.

B. Chiller System

The Permittee is required to perform monthly survey of visible emissions from the chiller system. If the opacity appears to exceed the standard, the Permittee is required to conduct EPA Method 9 observation by a certified EPA Reference Method 9 observer.

II. PERFORMANCE TESTING REQUIREMENTS

A. NSPS Requirements

Each combustion turbine is subject to the NO_X and SO_2 emission standards and the accompanying performance testing requirements under 40 CFR 60 subpart KKKK.

B. PM_{10}

The Permittee is required to perform an initial performance test for PM_{10} emissions using EPA 5 and EPA Method 202 within 60 days after achieving 300 fired hours on the CTG. Subsequent performance test shall be performed annually. . If at the end of any month, the 12-month rolling total of PM_{10} emissions for the 4 CTGs exceeds 13.5 tons, the test frequency shall change to semi-annual.

C. VOC

The Permittee is required to perform an initial performance test for VOC emissions within 60 days after achieving 300 fired hours on the CTG. Subsequent performance test shall be performed annually. Performance test for VOC emissions shall be performed using EPA Methods 25A/25B.

D. Ammonia

The Permittee is required to an annual perform test for ammonia slippage.

VII. IMPACTS TO AMBIENT AIR QUALITY

A dispersion modeling analysis was conducted by the Permittee to demonstrate compliance with National Ambient Air Quality Standard (NAAQS) and Arizona Ambient Air Quality Guideline (AAAQGs). The modeling analysis design, input parameters, and results are documented in Section 4 of the permit application. The modeling analysis took into consideration the combined impact of existing Griffith Energy facility and Northern Arizona Energy project, and the background ambient air quality data provided by ADEQ. The modeling analysis was reviewed, and the Department concluded that the modeling demonstrated compliance with both the NAAQS and the AAAQG. The results of the modeling analysis are summarized below:

Table 3: Summary of Maximum Modeled Concentrations and NAAQS Compliance

Pollutant	Averaging Period	Modeled Conc. (NAEP+ Griffith) (μg/m³)	Background Conc. (μg/m³)	Total Impact (μg/m³)	NAAQS (μg/m³)	Total Impact (% of Standard)
NO_X	Annual	8	4	12	100	12%
SO_2	3-hour	8	246	254	1,300	20%
	24-hour	2	52	54	365	15%
	Annual	0.3	6	6.3	80	8%
CO	1-hour	590	582	1172	40,000	3%
	8-hour	94	582	676	10,000	7%
PM_{10}	24-hour	14	46	60	150	40%
	Annual	1	14	15	50	31%

Table 4: Summary of AAAQG Modeling Results

AAAQG Pollutant	1-Hour Impact (μg/m³)	1-Hour AAAQG (μg/m³)	24-Hour Impact (μg/m³)	24-Hour AAAQG (μg/m³)	Annual Impact (μg/m³)	Annual AAAQG (μg/m³)
1,3-Butadiene	1.78E-03	7.20E+00	2.90E-04	1.90E+00	2.00E-05	6.70E-02
Acetaldehyde	1.67E-01	2.30E+03	2.76E-02	1.40E+03	2.0E-05	5.00E-01
Acrolein	2.76E-03	6.70E+00	4.63E-03	2.00E+00	--	--
Ammonia	--	--	1.69E+00	1.40E+02	--	--
Benzene	6.57E-02	6.30E+02	1.16E-02	5.10E+01	1.04E-03	1.40E-01
Ethylbenzene	1.51E-01	4.50E+03	2.58E-02	3.50E+03	--	--
Formaldehyde	9.46E-01	2.00E+01	1.57E-01	1.20E+01	1.12E-02	8.00E-02
Hexane	7.26E-01	5.30E+03	1.20E-01	1.40E+03		
Naphthalene	8.15E-03	6.30E+02	1.46E-03	4.00E+02	--	--
Propylene Oxide	4.45E+00	1.50E+03	2.37E-01	4.00E+02	3.77E-02	2.00E+00
Toluene	6.12E-01	4.70E+03	1.04E-01	3.00E+03	--	--
Xylenes	3.20E-01	5.50E+03	5.52E-02	3.50E+03	--	--

VIII. INSIGNIFICANT ACTIVITIES

The applicant has requested the following activities to be deemed as "insignificant". According to A.A.C. R18-2-101.57, for an activity to be deemed "insignificant", there should be no applicable requirement for the activity. This was the basis used to determine if the activities in the following list qualify as an "insignificant" activity under Arizona law.

TABLE 5: INSIGNIFICANT ACTIVITIES

Activity	Insignificant Yes/No	Reason and Applicable Regulation
Turbine Compartment Ventilation Exhaust Vents	Yes	A.A.C. R18-2-101.57(j)
Compressed Air System	Yes	A.A.C. R18-2-101.57(j)
Turbine Lube Oil Vapor extractors and Lube Oil Mist eliminator Vents	Yes	A.A.C. R18-2-101.57(j)
Sulfuric Acid Storage tanks Vents	Yes	A.A.C. R18-2-101.57(j)
Welding Equipment	Yes	A.A.C. R18-2-101.57(j)
Water Wash System Storage tank vent	Yes	A.A.C. R18-2-101.57(j)
Fuel Purge Vents	Yes	A.A.C. R18-2-101.57(j)
Oil/Water Separator Waste Oil Collection Tank Vents	Yes	A.A.C. R18-2-101.57(j)

IX. LIST OF ABBREVIATIONS

AAAQG.......Arizona Ambient Air Quality Guideline
A.A.C.......Arizona Administrative Code
ADEQ.......Arizona Department of Environmental Quality
ADHS.......Arizona Department of Health Services
AQD.......Air Quality Division
AQG.......Air Quality Guidelines
Btu/ft^3.......British Thermal Units per Cubic Foot
CO.......Carbon Monoxide
CO_2.......Carbon Dioxide
FERC.......Federal Energy Regulatory Commission
ft.......Feet
g.......Grams
HAP.......Hazardous Air Pollutant
hp.......Horsepower
hr.......Hour
IC.......Internal Combustion
lb.......Pound
m.......Meter
MMBtu.......Million British Thermal Units
$\mu g/m^3$.......Microgram per Cubic Meter
MMCFD.......Million Cubic Feet Per Day
NAAQS.......National Ambient Air Quality Standard
NO_x.......Nitrogen Oxide
O_3.......Ozone
PM.......Particulate Matter
PM_{10}.......Particulate Matter Nominally less than 10 Micrometers
PTE.......Potential-to-Emit
SO_2.......Sulfur Dioxide
TPY.......Tons per Year
TSP.......Total Suspended Particulate
USEPA.......United States Environmental Protection Agency
VOC.......Volatile Organic Compound
yr.......Year

EVALUATION OF THE PUMPING IMPACT OF THE NORTHERN ARIZONA ENERGY PROJECT (NAEP) ON THE MOHAVE COUNTY WATER SYSTEM WELL FIELD AND THE SACRAMENTO VALLEY AQUIFER MOHAVE COUNTY, ARIZONA

Prepared for:
Northern Arizona Energy, LLC
c/o Moyes Storey, Ltd.
1850 North Central Avenue
Suite 1100
Phoenix, Arizona 85004

Prepared by:
Southwest Ground-water Consultants, Inc.
3033 North 44th Street
Suite 120
Phoenix, Arizona 85018

REGISTERED GEOLOGIST
CERTIFICATE NO.
17065
STEPHEN D.
NOEL
Date Signed 6/21/07
ARIZONA, U.S.A.

June 21, 2007

TABLE OF CONTENTS

REGISTERED GEOLOGIST
CERTIFICATE NO.
17065
STEPHEN D.
NOEL
Date Signed 6/21/07
ARIZONA, U.S.A.

LIST OF ATTACHMENTS

Attachment No.

1.0 BACKGROUND

The Northern Arizona Energy Project (NAEP) is proposing to install a 175 MW natural gas fired simple cycle power plant located adjacent to the Griffith Energy Project south of Kingman, Arizona. Raw water will be required for process water supply. The water demand will average 160 acre-feet per year (ac-ft/yr) based on an expected 2,500 annual operating hours. The "theoretical worst case" water demand is 268 ac-ft/yr which is based on a hypothetical 5,000 annual operating hours. The Northern Arizona Energy Project is expected to operate for 40 years.

The proposed water supply for the NAEP is ground water from the Sacramento Valley Aquifer pumped by the Mohave County Water System Well Field (County Well Field) located in Sections 10, 11, 14, and 15, Township 19 North, Range 18 West. The well field is located approximately two miles southwest of the NAEP Project Site.

Reports and data sources utilized in this current analysis to document the availability of ground water from the County Well Field are referenced below.

- Arizona Department of Water Resources (ADWR) Records.
- ADWR, 1994 Staff Report on Kingman Area Water Supply and Demand, (Regarding need to establish an AMA in the Sacramento or Hualapai Basins). Phoenix, Arizona.
- Arizona Department of Water Resources, August 14, 2006. Analysis of Adequate Water Supply – Golden Valley 5800. File Number 23-401823.0001. Signed by Sandra Fabritz-Whitney, Assistant Director, Water Management Division.
- Errol L. Montgomery & Associates, Inc. July 25, 2005. Consultants Report – Regional Hydrogeology, Source of Water Supply, and Projected 100-Year Drawdown Impacts in the Vicinity of the Golden Valley South Master Planned Community, Mohave County, Arizona.
- Manera, Inc. August 3, 1998. Consultants Report – Preliminary Hydrogeologic Evaluation, Griffith Energy Well Field, Sacramento Valley, Mohave County, Arizona.
- Manera, Inc. November 13, 2006. Consultants Report – Hydrologic Evaluation, Sacramento Valley, Mohave County, Arizona, Golden Valley County Improvement District No.1 Report.

2.0 SACRAMENTO VALLEY AQUIFER

2.1 Aquifer Geometry

The Sacramento Valley ground-water basin is comprised of a thick sequence of alluvial deposits underlain by granitic, metamorphic, and volcanic bedrock. The alluvial deposits range in thickness from zero feet along the basin margins to greater than 3,200 feet in the north-central portion of the basin. The lower alluvial unit is the primary aquifer in the Sacramento Valley ground-water basin.

A summary of the depth to bedrock and the ground-water surface in the Sacramento Valley and study area is presented in Attachment I (Montgomery, 2005). Review of this figure and ground-water level data from ADWR indicates:

1) Depth to bedrock is greatest in the north-central portion of the basin and is approximately 1,600 to 3,200 feet below land surface (bls) in the County Well Field area;
2) ground-water flow direction is south along the axis of the valley; and
3) depth to ground water at the County Well Field ranges from approximately 530 to 630 feet bls due specifically to variations in land surface elevations (Figure 1, Attachment II).

The saturated thickness of the regional aquifer in the vicinity of the County Well Field was conservatively calculated to be 770 feet. That thickness is based on a depth to bedrock of 1,400 feet bls and a depth to ground water of 634 feet bls (Figure 1, Attachment II; see well # 55-580149).

Using a generally accepted rule that the practical recoverable volume of ground water from the aquifer is 66% of the total saturated thickness, and based on a saturated thickness of 770 feet at the County Well Field, this equates to a projected maximum drawdown of 508 feet (770 feet x 66%) or recoverable depth to water of 1,142 feet bls.

2.2 Aquifer Parameters

The aquifer parameters of transmissivity (gallons per day per foot) and hydraulic conductivity (gallons per day per square foot), including the testing conducted by Manera at the County Well Field, were summarized and reported by Montgomery (2005). Review of these aquifer test results indicates that the aquifer transmissivity of the lower alluvial unit ranges from 17,000 gpd/ft to 200,000 gpd/ft, and the specific yield is approximately 0.07.

ADWR used an average transmissivity value of 33,750 gpd/ft, a specific yield of 0.07, and an average aquifer saturated thickness of only 435 feet in its review of the Golden Valley 5800 Analysis of Adequate Supply Application (Attachment III, Office of Assured and Adequate Water Supply, Hydrology Review, File No. 23-401823, Golden

Valley 5800). The Golden Valley 5800 proposed withdrawal site is located four miles north of the County Well Field.

The more conservative ADWR-approved aquifer parameters are used in this report to evaluate the NAEP pumping impact on the aquifer (Section 4.2).

3.0 REGIONAL GROUND-WATER PUMPING

The major current and projected demands on the regional aquifer are presented in the chart below.

CURRENT AND PROJECTED REGIONAL GROUND-WATER DEMAND			
Project	Pumped Volume (acre-feet/year)	Source	Remarks
Golden Valley 5800 (Rhodes Homes)	14,714*	Montgomery, July, 2005. Regional Hydrogeology, Source of Water Supply, and Projected 100-Year Drawdown Impacts in the Vicinity of the Golden Valley South Master Planned Community, Mohave County, Arizona.	Montgomery (2005) Application with impact analysis was for 14,714 ac-f/yr. ***ADWR approved only 9,000 acre-feet per year**; therefore, the Montgomery projected drawdown impact is overstated by approximately 40% versus the ADWR allowable pumping rate.
GVID	7,211	Manera, November 13, 2006. Hydrologic Evaluation, Sacramento Valley, Mohave County, Arizona, Golden Valley County Improvement District No.1.	GVID demand – 1,400 ac-ft/yr; Valley Pioneer Water Company – 2,811 ac-ft/yr; Mineral Park Mine Call – 3,000 ac-ft/yr.
Mohave County Water System (County Well Field)	5,323	Manera, August 3, 1998. Preliminary Hydrologic Evaluation, Griffith Energy Well Field, Sacramento Valley, Mohave County, Arizona.	This pumped volume represents the "worst case" – maximum day pumping 365 days per year. The more probable pumping rate is projected at 3,060 ac-ft/yr. However, the actual pumping rate for 2001 – 2006 averaged only about 1,200 ac-ft/yr.
NAEP	268	Northern Arizona Energy, LLC.	"Worst case" – maximum theoretical 5,000 operating hours. Probable pumping 160 ac-ft/yr and 2,500 operating hours.
Total Impact	**27,516 (21,802)****		Represents worst case conditions which are not anticipated to occur. ****Accounts for ADWR approved 9,000 ac-ft/yr (out of 14,714 ac-ft/yr requested) for the Golden Valley 5800 Project.**

4.0 AQUIFER IMPACT ANALYSIS

The projected regional aquifer impacts presented below incorporate calculations and conclusions prepared by Manera (1998, 2006) and Montgomery (2005). These analyses used the THWELLS analytical method.

4.1 Golden Valley, GVID, and Griffith Energy Project Aquifer Impacts

Previous investigations into pumping impacts on the regional aquifer underlying the County Well Field include Manera (1998, 2006) for the Griffith Energy Project and GVID, respectively, and Montgomery (2005) for Golden Valley 5800. The projected impacts of those projects and investigations are presented in the following chart.

REGIONAL PUMPING IMPACTS					
Project	Pumped Volume (acre-feet/year)	Time (years)	Drawdown Impact at County Well Field (feet)	Source	Remarks
Golden Valley 5800 (Rhodes Homes)	14,714*	100	115 The ADWR approved volume of 9,000 ac-ft/yr results in a drawdown of approximately 40% less, or 61 feet.	Montgomery, July, 25 2005. Regional Hydrogeology, Source of Water Supply, and Projected 100-Year Drawdown Impacts in the Vicinity of the Golden Valley South Master Planned Community, Mohave County, Arizona.	Golden Valley 5800 Application and impact analysis was for 14,714 acre-feet per year. ***ADWR approved only 9,000 ac-ft/yr.**
GVID	7,211	100	55	Manera, November 13, 2006. Hydrologic Evaluation, Sacramento Valley, Mohave County, Arizona, Golden Valley County Improvement District No.1.	GVID demand – 1,400 ac-ft/yr, Valley Pioneer Water Company – 2,811 ac-ft/yr, Mine Call – 3,000 ac-ft/yr.
Mohave County Water System (County Well Field)	5,323**	40	110 **The more probable pumping volume of 3,060 ac-ft/yr results in a drawdown of 70 feet (Manera, 1998).	Manera, August 3, 1998. Preliminary Hydrologic Evaluation, Griffith Energy Well Field, Sacramento Valley, Mohave County, Arizona.	Worst Case – maximum day pumping 365 days per year. ** Probable pumping is 3,060 ac-ft/yr.

Selected portions from the Golden Valley 5800 (Montgomery, 2005), GVID (Manera, 2006), and Griffith Energy Well Field (Manera, 1998) reports are presented in Attachment IV, for reference.

In the 1998 Report, Manera analyzed the potential impacts on the Sacramento Valley aquifer using the "probable" and "worst case" water demand scenarios. However, due to the electric power market conditions from 2001 through 2006, the annual operating hours and actual water demand for the Griffith Energy Project resulted in annual pumping volumes that were considerably less than the estimated scenarios. See below:

GRIFFITH ENERGY GROUNDWATER PROJECTED AND ACTUAL USE		
Griffith Energy Demand	**Annual Volume** (acre-feet/year)	**Remarks**
Estimated Probable Case	3,060*	Based on expected operating profile. * Manera, 1998.
Estimated Worst Case	5,323*	Continuous maximum peak demand, 365 days/yr. *Manera, 1998.
Average Actual Case (from 2001 through 2006)	1,200**	Actual use range: 875 – 1,600 ac-ft/yr. **Griffith Energy, 2007.

Actual water use over Griffith Energy's first six years of operation was approximately 24,702 ac-ft less than the calculated impact of the "worst case" pumping scenario that was the basis for Maner's (1998) impact analysis (Attachment V). This savings in pumped water is equivalent to 92 years of pumping the "worst case" NAEP demand at 268 ac-ft/yr, or 154 years under the likely annual pumping volume of 160 ac-ft/yr. As a result, the impact of the proposed new NAEP demand on the aquifer over its entire project life of 40 years has already been taken into account as part of the initial aquifer impact projections (Manera, 1998) for the Griffith Project and by subsequent studies. Therefore, no additional impacts on the underlying regional aquifer, beyond those already accounted for in the relevant aquifer studies, will occur as a result of the proposed NAEP ground-water demand.

4.2 NAEP Aquifer Impact

The impact analysis of the proposed NAEP water demand on the regional aquifer was calculated by SGC using aquifer parameters approved by ADWR in its review of the Golden Valley 5800 Analysis of Adequate Water Supply, and the program THWELLS v 4.01 multi-Theis analysis software (van der Heijde, 1996). The THWELLS analysis simulates one production well using the "worst case" pumping rate of 268 ac-ft/yr, and image well boundaries consistent with the boundary locations used by Montgomery (2005). The locations of the proposed well and image well boundaries are shown in Attachment VI (Figure 2).

Considering only aquifer impacts caused by NAEP's "worst case" withdrawal scenario, the maximum drawdown at the pumping well would be 15 feet after 40 years of continuous pumping (see Attachment VI, Figure 2). Alternatively, the projected drawdown would be 5.7 feet at a distance of 1,000 feet from the pumping well. As noted above, Manera (1998) concluded that the Griffith Energy Project withdrawals over 40 years would result in a drawdown of 110 feet at the well for the "worst case," and 70 feet for the more probable pumping volume. However, the actual annual pumping volumes have been considerably less than even the "probable case." Thus, actual drawdowns are less than those projected. Consequently, combining the projected 15 feet of drawdown at the pumping well under NAEP's "worst case" scenario with the actual drawdown likely results in a total impact that is still less than Manera's (1998) previously projected impact for the County Well Field of 110 feet.

4.3 Cumulative Aquifer Impact

The projected drawdown at the County Well Field was conservatively estimated using "worst case" annual pumping for NAEP (40 years), the Griffith Energy Project (40 years), the Golden Valley 5800 (100 years), and GVID projects (100 years), as well as accounting for the regional decline trend. A schematic of the drawdown projections at the County Well Field is presented in Attachment VII, Figure 3.

Based on these projected worst case withdrawals, the cumulative aquifer impact at the County Well Field is 395 feet. This projected drawdown is less than the 508 feet that comprises the saturated thickness' practical recoverable volume (66% of saturated thickness, Section 2.1). Thus, even after considering the projected "worst case" demand of all other major ground-water pumping, NAEP, and regional trends, the aquifer still has additional pumping capacity at the County Well Field.

4.4 Summary

The Northern Arizona Energy Project's maximum pumping requirement is 10,720 acre-feet over 40 years. Projected drawdown at the pumping well caused by NAEP's maximum pumping requirement is 15 feet. NAEP's 40-year pumping requirement and projected drawdown, however, are already accounted for in water savings. This savings is due to the difference between the County Well Field's initial projections and actual pumping from 2001 through 2006. Specifically, the County Well Field saved 24,702 acre feet over the first six years of operation, or more than two times NAEP's maximum lifetime pumping requirement. Consequently, no additional impact on the aquifer will be realized due to NAEP.

5.0 REFERENCES

Arizona Department of Water Resources. August 14, 2006. Analysis of Adequate Water Supply – Golden Valley 5800. File Number 23-401823.0001. Signed by Sandra Fabritz-Whitney, Assistant Director, Water Management Division.

Arizona Department of Water Resources (ADWR) Records.

Errol L. Montgomery & Associates, Inc. July 25, 2005. Consultants Report – Regional Hydrogeology, Source of Water Supply, and Projected 100-Year Drawdown Impacts in the Vicinity of the Golden Valley South Master Planned Community, Mohave County, Arizona.

Manera, Inc. August 3, 1998. Consultants Report – Preliminary Hydrogeologic Evaluation, Griffith Energy Well Field, Sacramento Valley, Mohave County, Arizona.

Manera, Inc. November 13, 2006. Consultants Report – Hydrologic Evaluation, Sacramento Valley, Mohave County, Arizona, Golden Valley County Improvement District No.1 Report.

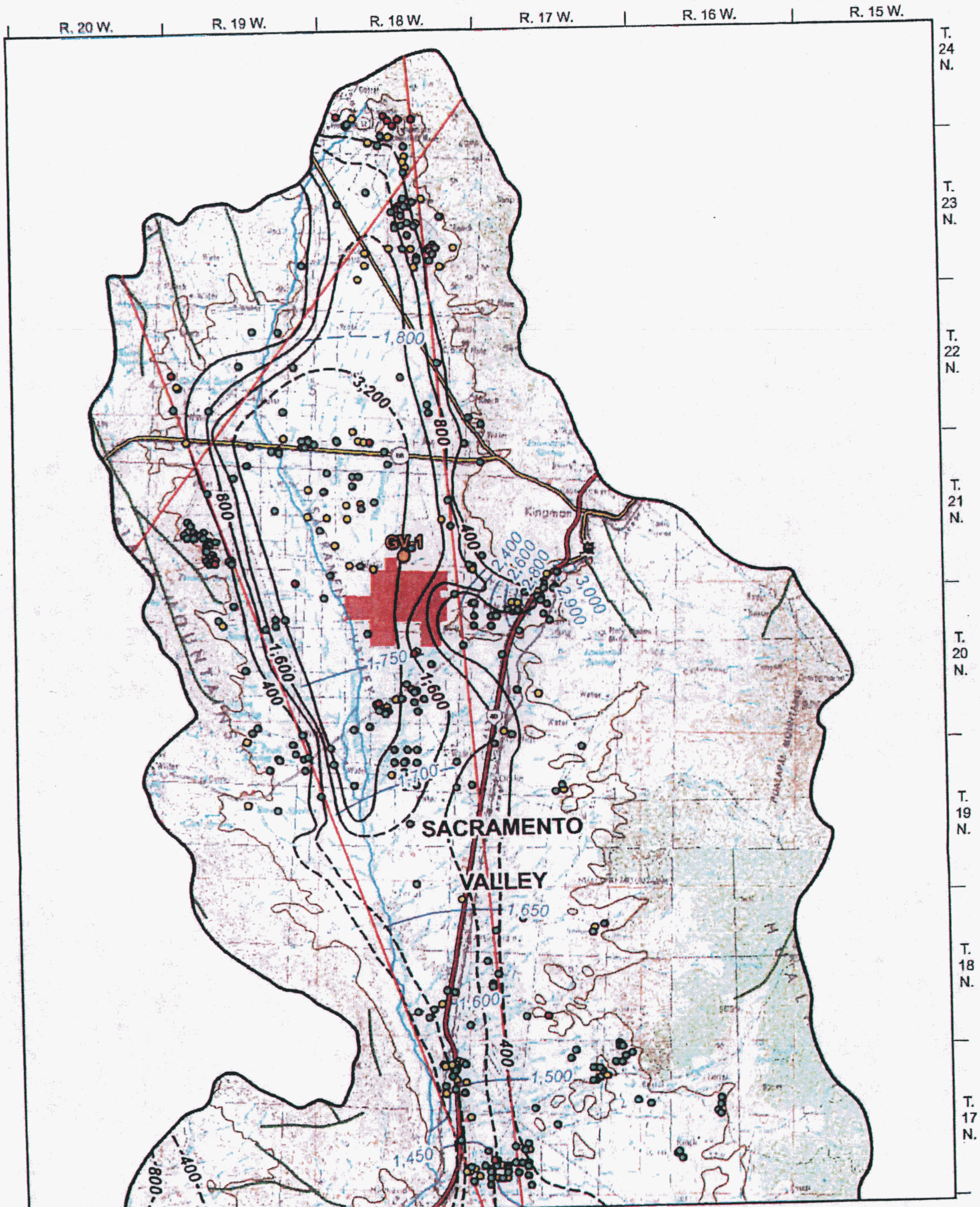
van der Heijde. 1996. THWELLS, Flow in Confined or Unconfined Aquifer with Multiple Wells. Released by International Ground-water Modeling Center, May, 1996, v. 4.01.

ATTACHMENTS

Attachment I

ATTACHMENT I

Montgomery, 2005, Figure 1
Location Map for Sacramento Valley



Note: Wells in bedrock areas are not included.

EXPLANATION

- Well from ADWR Groundwater Site Inventory
- Well from ADWR 55 Registry Inventory
- Well from ADWR 35 Registry Inventory
- New Well GV-1, B(21-18)34dba
- Fault (Arizona Geological Survey Digital Information Series 08, Ver. 3.0)
- Bedrock Boundary (ADWR Hydrologic Map Series, Report No. 21, 1991)
- Approximate Depth to Bedrock, in feet; dashed where unknown (Oppenheimer & Sumner, 1980)
- Boundary of Groundwater Basin (ADWR Hydrologic Map Series, Report No. 21, 1991)
- Groundwater Level Altitude Contour of 1990, in feet msl (ADWR Hydrologic Map Series, Report No. 21, 1991)
- Hydrologic Model Boundary
- Golden Valley South Master Planned Community

FIGURE 1. LOCATION MAP FOR SACRAMENTO VALLEY

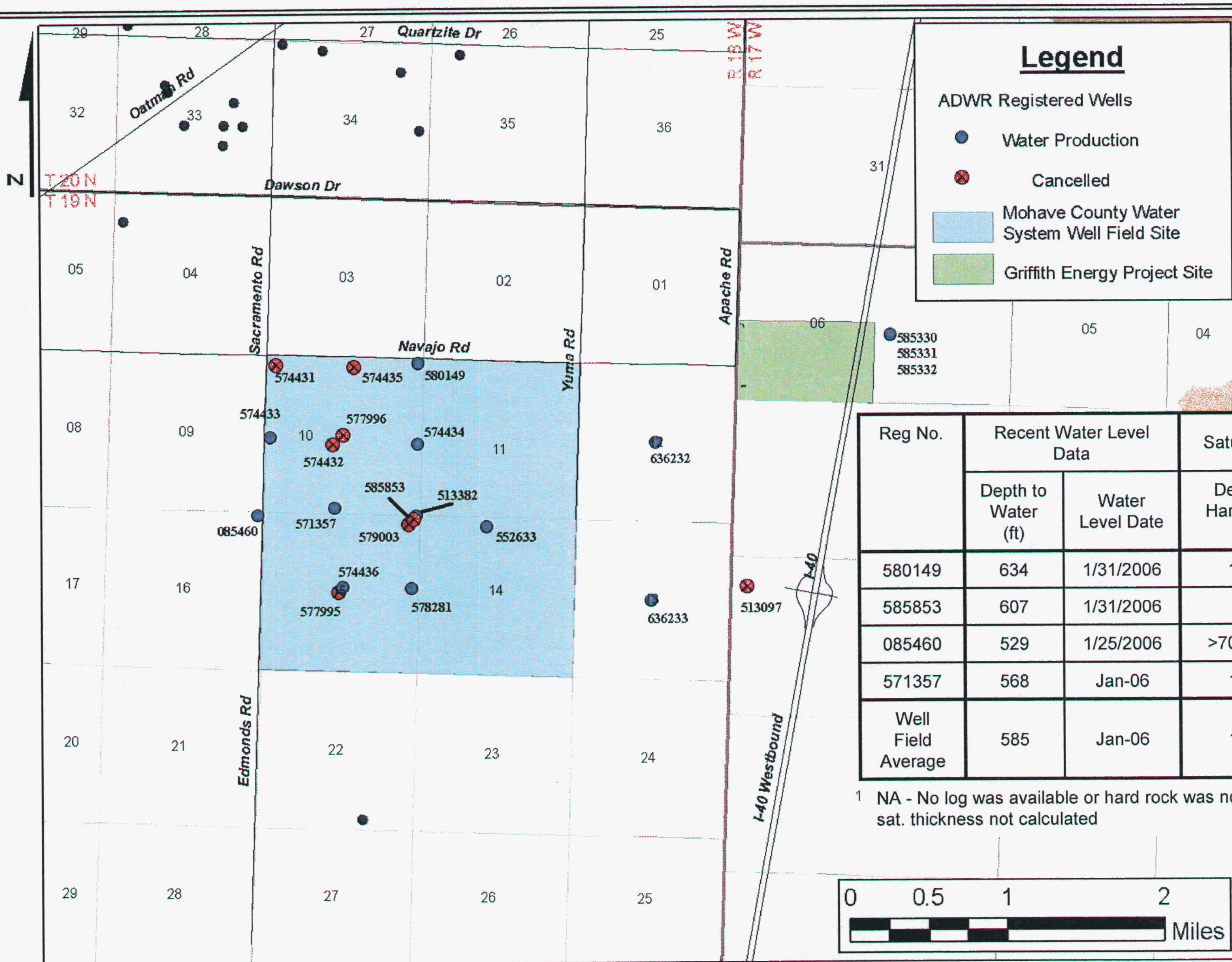
GISDATA\Projects\440.21\SacramentoValleyBasin_extend.mxd UTM NAD27 12July2005

ERROL L. MONTGOMERY & ASSOCIATES, INC.

Attachment II

ATTACHMENT II

Figure 1 - Well Locations, Depth to Water, and Saturated Thickness



Reg No.	Recent Water Level Data		Saturated Thickness	
	Depth to Water (ft)	Water Level Date	Depth to Hard Rock (ft)	bsat (ft)
580149	634	1/31/2006	1400	766
585853	607	1/31/2006	NA	NA
085460	529	1/25/2006	>700 (NA)	NA
571357	568	Jan-06	1500	932
Well Field Average	585	Jan-06	1450	849

1 NA - No log was available or hard rock was not reached, so sat. thickness not calculated

Southwest Ground-water Consultants, Inc.

April 26, 2007 Project B.1476

WELL LOCATIONS, DEPTH TO WATER, AND SATURATED THICKNESS

Mohave County Water System Well Field, Mohave County, Arizona

Figure 1

Attachment III

ATTACHMENT III

ADWR Office of Assured and Adequate Water Supply, Hydrology Review, File No. 23-401823, Golden Valley 5800

ARIZONA DEPARTMENT OF WATER RESOURCES
Office of Assured and Adequate Water Supply
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2465
Fax (602) 417-2467

Janet Napolitano
Governor

Herbert R. Guenther
Director

ANALYSIS OF ADEQUATE WATER SUPPLY

October 19, 2005

File Number:	23-401823.0000
Development:	Golden Valley 5800
Location:	Township 20 North, Range 18 West, Sections 2, 3, 4, 8, 9, 10, 11, 14, 16 Township 21 North, Range 18 West, Section 34 Mohave County, Arizona
Land Owner:	American Land Management, L.L.C.

The Arizona Department of Water Resources has evaluated the Analysis of Adequate Water Supply application for Golden Valley 5800 pursuant to A.A.C. R12-15-723. The proposed development includes 32,000 single-family residential lots. Water provider for the master planned community has not yet been selected. Conclusions of the review are indicated below based on the adequate water supply criteria referenced in A.R.S. § 45-108 and A.A.C. R12-15-701, 715, 723 *et seq.*

- **Physical, Continuous, and Legal Availability of Water for 100 Years**
  On the basis of the Department's review, the Department has determined that 9,000.00 acre-feet per year of groundwater will be **physically available**, which is less than the applicant's projected build out demands for the development, including system losses, of 15910.90 acre-feet per year. The application did not specify a provider, and the water provider has not yet been selected. Therefore, both **legal availability** and **continuous availability** of the water are not proven at this time. These requirements of an Analysis of Adequate Water Supply will be re-evaluated for each application for a Water Adequacy Report. Applications for Water Adequacy Reports that follow the Analysis of Adequate Supply will need to reference this letter to demonstrate physical availability. Individual Notices of Intent to Serve will be required for each application for a Water Adequacy Report.

- **Adequate Water Quality**
  Water quality has not been demonstrated at this time. This requirement of an Analysis of Adequate Water Supply will be re-evaluated for each application for a Water Adequacy Report.

The term of this Analysis of Adequate Water Supply is ten years from the date of this letter and may be renewed upon request, subject to approval by the Department. Throughout the term of this determination, the projected demand of this development will be considered when reviewing other requests for adequate water supply in the area.

Prior to obtaining plat approval by the local platting authority and approval of the public report by the Department of Real Estate, a Water Adequacy Report must be obtained for each subdivision plat. The findings of this Analysis of Adequate Water Supply may be used to demonstrate that certain requirements for a Water Adequacy Report have been met. This determination may be invalidated if the development plan or other conditions change prior to filing for a Water Adequacy Report.

Questions may be directed to the Office of Assured/Adequate Water Supply at (602) 417-2465.

Sandra Fabritz-Whitney

Sandra Fabritz-Whitney, Assistant Director
Water Management Division

cc: Greg Wallace, E. L. Montgomery and Associates
Alan R. Dulaney, Office of Assured/Adequate Water Supply

23-401823.0000
GOLDEN VALLEY 5800

RECEIVED
JUL 18 2005
OFFICE OF ASSURED WATER SUPPLY

Arizona Department of Water Resources
OFFICE OF ASSURED AND ADEQUATE WATER SUPPLY
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004-3921
(602) 417-2460

APPLICATION FOR AN ANALYSIS OF WATER ADEQUACY

(Refer to application guidelines for assistance in completing this form)

PART A - GENERAL INFORMATION

1. Name of development: Golden Valley 5800

2. Location: 20N (Township) 18W (Range) 2,3,4,8,9,10,11,14,16 (Section(s)) Mohave (County)

2. Location: 21N (Township) 18W (Range) 34 (Section(s)) Mohave (County)

3. Owner Name: AMERICAN LAND MANAGEMENT LLC Phone: 702-873-5582 Address: 4730 South Fort Apache Road, Suite 300 - Las Vegas, NV 89147

4. Water Provider: Pioneer Valley water co. or new water company (undecided) Phone: ________ Address: ________

5. Consultant Name: Errol L. Montgomery and Associates, Inc. Phone: 48-948-7747
   Address: 7949 East Acome Drive, Suite 100 Scottsdale, AZ. 85260

6. Primary Contact:
   Name: Greg Wallace Phone: 602-818-2399
   Address: 7949 East Acome Drive, Suite 100 Scottsdale, AZ. 85260

PART B - WATER DEMAND INFORMATION

1. Include a map of the proposed development, and reference as an attachment: Attatchment 1

2. Number of lots: 32,000 Size of lots: 7500 Total Acreage: 5,800

3. Total demand projected for development: 16,000 acre-feet (AF) per year
   Projected water demand per residential lot: .58 gallons per day
   Non-Residential demands: Golf course: 600 AF/year Parks: 230 AF/year Lakes: ______ AF/year
   Other (specify): ____________ ______ AF/year

4. Expected year of completion (build-out): 2015

PART C- WATER SUPPLY INFORMATION

1. Please indicate source(s) of water to be used: X Groundwater __ Surface Water __ Effluent
(If the sources includes non-groundwater supplies, please complete "Supplement C.")

2. Provide a hydrologic study, and reference the attachment: #5

3. a. Method of water distribution: X central distribution system __ dry lot subdivision (individual wells)

   b. If water is to be obtained from a water provider, include a "Notice of Intent to Serve" agreement and reference the attachment: ____________

4. If any wells proposed to serve the development are within one mile of a Water Quality Assurance Revolving Fund or Superfund site (or any monitor wells associated with the site), or if the proposed water supply fails to meet safe drinking water quality standards, provide a study identifying and describing this water and reference the attachment: N/A

5. If a "Letter of Water Availability" has previously been issued for this provide a copy of the document and reference the attachment: n/a

PART D - FEES

The application fee for an Analysis of Water Adequacy is $ 1,000. The payment may be made by cash, check, or in some cases, by entry in an existing Department fee credit account. Checks should be made payable to the Department of Water Resources. **Failure to enclose the required fees will cause the application to be returned.**

Fee for Application for Analysis of Water Adequacy: $ 1000.00

I DO HEREBY certify that the information contained in this application and all information accompanying it is true and correct to the best of my knowledge and belief.

Charles Sakura	Charles Sa C	6/9/05
Owner Name (Please type or print)	Signature	Date

ARIZONA DEPARTMENT OF WATER RESOURCES

OFFICE OF ASSURED WATER SUPPLY
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004
(602) 417-2460

SUPPLEMENT TO APPLICATION FOR AN ANALYSIS OF ADEQUATE WATER SUPPLY

NOTICE OF INTENT TO SERVE

Municipal Water Provider Name (please type or print): Perkins Mountain Water Company

ADEQ Public Water System Number (please indicate the number valid for this subdivision): ____________

Subdivision/Development Name: Golden Valley South

The undersigned municipal water provider agrees to provide to the development indicated above an amount of water sufficient to satisfy the water demands of the development as stated in the application for an analysis of adequate water supply or water adequacy. This Notice of Intent to Serve is conditioned upon the provider's receipt of necessary approvals from the Arizona Corporation Commission and other regulatory agencies, and the provider's receipt of all necessary payments.

The municipal water provider, if a private water company, further attests that the subject development is either within the boundaries of the company's existing Certificate of Convenience and Necessity or that a formal request has been filed with the Arizona Corporation Commission to extend the boundaries to include the development.

This Notice of Intent To Serve Agreement is agreed to under the signature of an agent of the municipal water provider authorized to sign the agreement:

Name of Municipal Water Provider's authorized agent (please type or print): Kirk Brynjulson

______________________________ 6/3/05
Signature of Authorized Agent of Municipal Water Provider — Date

AFFIDAVIT OF AUTHORITY

I, Charles Sakura, the undersigned authority, hereby declare under penalty of perjury that I have the right and the authority to execute any and all documents on behalf of American Land Management, LLC including but not limited to the Arizona Department of Water Resources Application for an Analysis of Water Adequacy together with any supplements thereto.

Dated this 16th day of February, 2005.

Charles Sak

Charles Sakura, Manager
American Land Management, LLC

Parcel Information (Click for Tax Information)

Tax Year:	2005
Parcel:	215-01-080 **Click for Improvement Information**
Site Address:	UNK STREET ADDRESS
Owner:	DESERT COMMUNITIES INC ATTN: M WALKER
Mailing Address:	4730 S FORT APACHE RD STE 300 , LAS VEGAS , NV 89147
Tax Area:	0430
Full Cash Value:	$60,421.00
Assessed Full Cash Value:	$9,667.00
Limited Value:	$60,421.00
Assessed Limited Value:	$9,667.00
Value Method:	Land Market Model
Exempt Amount:	$0.00
Exemption Type:	
Use Code:	0004
Property Use:	VACANT LAND
Class Code:	Ag, Vacant Land or Non-profit
Assessment Ratio:	16.00%

Last Sale Information (Click for more Sale Info)

Sale Price:	0
Sale Date:	1/3/2005
Recorded Instr Type:	WARRANTY DEED
Book:	5273
Page:	721

Legal Description Information

Parcel Size:	604.21 ACRES
Township, Range and Section:	20N 18W 2
Legal Description:	ALL EXCEPT THE SE4 SE4, W2 NW4 NW4 NW4 NE4 NE4 & EXCEPT THE N & W 50' CONT 604.21 AC 215-01-005(215-01-080 & COUNTY RD)

BACKGROUND INFORMATION

Office of Assured and Adequate Water Supply
General Information and Review Status - Adequate

File Number **23-401823.0000**

Subdivision **Golden Valley 5800**

Owner **American Land Management LLC**

County **Mohave**

Quadrant **T 21 R 18 S 34 1/4s**
20 18 2,3,

Consultant **Errol L. Montgomery & Associates, Inc.**

Water Provider **To Be Determined**

Date Received **07/18/2005**

Application Status **Issued**

Status Date **10/19/2005**

REVIEW / APPROVAL STATUS

OAWS	**Alan Dulaney**	☑ Approved	☐ Not Approved	Date **08/02/200**
Water Quality	**Alan Dulaney**	☐ Approved	☑ Not Approved	Date **07/27/200**
Hydrology	**A. Kurtz**	☑ Approved	☐ Not Approved	Date **09/06/200**
Legal	**Maxine Becker**	☑ Approved	☐ Not Approved	Date **10/21/200**
CRM		☐ Approved	☑ Not Approved	Date

Office of Assured and Adequate Water Supply
Adequacy Application Review

File Number **23-401823.0000** Subdivision **Golden Valley 5800**

Application complete	☑
Hydrologic study attached	☑
Contracts attached	☑
Plat	☑
Correct Fees	☑
Signed NOI	☐

Application Routed to:

Hydro	☑	Date **07/27/2005**
WQ	☑	Date **07/27/2005**
Legal	☑	Date **10/19/2005**
Chief Hydrologist	☐	Date
CRM	☐	Date

Number of Lots **32000**

City/County Platting Authority **Mohave County**

Dry Lot	☐
CCN	☐

Time Frame

1st Letter
1st Response
2nd Letter
2nd Response
3rd Letter
3rd Response

Demand Totals, af/yr

Residential	**9,684.85**
Non Residential	**4,768.54**
Construction	**12.17**
Lost + Unaccounted	**1,445.34**
Total Annual Demand	**15,910.90**

100 year demands

Groundwater	**1,591,090.00**
Effluent	
Surface Water	
CAP Water	
Colorado River	
Total 100 yr Demand	**1,591,090.00**
Applicant's Estimate	**1,471,381.00**

Comments **Location T 20N, R 18W, Sec. 2,3,4,8,9,10,11,14 & 16 and T 21N, R 18W, Sec. 34. This is an Analysis of Adequate Water Supply for a very large area west of Kingman. No maps for the master plan community were included. Application was signed by Charles Sakura, but no signatory authority from American Land Management was provided. Provider is undetermined at this time, so no NOI. Legal, continuous availability cannot be established with this application, only physical availability. Incomplete letter may be needed. UPDATE: Consultant faxed over an affadavit affirming signatory authority for Charles Sakura. Also, NOI to Serve from Perkins Mountain Water Company, but this may not be provider. Awaiting Hydrology approval. ARD, 8/2/05. UPDATE: Hydrology has determined that only 9000 afa have been demonstrated as physically available; letter will be written with this amount. Draft sent to Legal. 10/19/05, ARD. Sent for Assistant Director's signature.**

OAWS Reviewer **Alan Dulaney** Approved ☑ Not Approved ☐ Date **08/02/2005**

Office of Assured and Adequate Water Supply
Legal Review - Adequacy

File Number **23-401823.0000** **Subdivision** **Golden Valley 5800**

Legal Ownership/Authority

Proof of Ownership for non-indivdual owners, principals/beneficaries holding 10 % or greater interest identified	Yes
Owner / representative signed application	Yes

Approval of other Divisions

Hydrology	Yes
Water Quality	Yes
OAWS	Yes

Legal Availability

Contracts Verfified	No
Non-CAP / Colorado River SW	No
Certificated/Decreed/Pre-1919/ Appurtenant	No
Evidence of Use / Non-Abandonment (Last Five Years)	No
NOI to Serve verified	Yes

Comments **No division checksheets in file. MMB 10/20/05. Analysis approved w/one edit to letter. MMB 10/21/05**

Legal Reviewer **Maxine Becker** MMB Approved ✓ Not Approved ☐ Date **10/21/2005**

Office of Assured and Adequate Water Supply
Hydrology Review

File Number **23-401823.0000** Subdivision **Golden Valley 5800**

SubBasin	SAC	Aquifer description	layered volcanics , basin fill alluvium(???
Depth to Water, ft	765	Regional decline, ft/yr	1
T, g/d/ft	33750	Groundwater stored, af	0
SY, %	7	Recharge, af/yr	
Sat Thickness, ft	435	Groundwater Flux, af/yr	
		Method of Analysis	theis

Impact

Projected water level decline, ft/yr 4.35

Within area of impact of a recharge facility? ☐

If yes, is criteria met w/o considering stored water? ☐

Estimated Depth to Water After 100 Years:

min, ft	1161	Location	on property
max, ft	1200	Location	on property

Surface Water Supply Analysis

Source	not applicable	Firm yield, af/yr	0
SW Right No.	0	Median flow, af/yr	0.000

Type of Right: decree ☐ Pre-1919 Right ☐ Cert. of Appropriation ☐ Permit of Appropriation ☐

Demand

Applicant's projected demand, af/100 yrs	1500000
AMA's projected demand, af/100 yrs	1591090
Demand served by service area wells, af/100 yrs	0

Groundwater Supply

Basis of Physical Availability

☐ Water Availability Letter/PAD

☐ Analysis

Year 2005

File No.

☑ Study included w/ application

☐ Hydrologic data on file

Model used thwells

Original amount of physical availability, af/yr 9000

Balance after this application, af/yr 9000

Comments **The hydrologic study does not conclusively demonstrate quantity and dependability of the groundwater supply for 15,000 ac-ft/yr. Issues exist with the aquifer test data, use of Thwells for impact analysis over the entire basin, lack of committed demand for the entire basin, etc. However, the reviewer attempted to account for the hydrologic study's weaknesses and determined that a maximum demand of 9000 ac-ft/yr could be approved for the development. This would virtually eliminate any further development via groundwater adjacent to and north of the master planned community until more data becomes available that provides evidence of additional groundwater supplies. (A.Kurtz 9/10/05, KM 10/6/05) Approved at this time for maximum demand of 9000 AF/yr only.**

Hydrologist	**A. Kurtz**	Approved ☑	Not Approved ☐	Date	**09/06/2005**
Section Manager	**K. Modesto**	Approved ☑	Not Approved ☐	Date	**10/06/2005**

Office of Assured and Adequate Water Supply
Water Quality Review

File Number **23-401823.0000** Subdivision **Golden Valley 5800**

Water Provider	**undetermined**
PWS Number	
New Provider (checked if yes)	☐
Is Water Provider in compliance with Safe Drinking Water Standards, per ADEQ/County?	**NA**
Is there a known WQARF, Superfund, or Solid Waste site within one mile?	**No**
Are there expected changes to water quality so as to make it likely that the pledged water supply in the future will not meet current water quality standards?	**No**

Comments: **No provider has been selected at this time. No water quality approval is possible for this Analysis of Adequate Water Supply. Water quality will have to be established later with individual Water Adequacy Report applications.**

Preliminary WQ Reviewer	**Alan Dulaney**	☐ Approved	☑ Not Approved	Date	**07/27/2005**
Final WQ Reviewer	**Alan Dulaney**	☐ Approved	☑ Not Approved	Date	**07/27/2005**

CHECK DEPOSIT REQUEST
OFFICE OF ASSURED AND ADEQUATE WATER SUPPLY

SUBMITTED BY Patricia Smith

DATE: July 20, 2005

APPLICANT: American Land Management LLC

CHECK SENT BY: Errol L. Montgomery & Associates, Inc.

NAME OF COMPANY OTHER THAN APPLICANT)

FILE PREFIX	TYPE OF FILING FEE	PUBLIC NOTICE FEE	APP. FEE	TOTAL AMOUNT OF CHECK
20-	Application for a Physical Availability Demonstration (PAD)			
21-	Application for a Designation of Adequate Water Supply			
22-	Application for a Water Adequacy Report			
23- 401823.0000	Application for an Analysis of Water Adequacy		1,000.00	1,000.00
26-	Application for a Designation of Assured Water Supply			
27-	Assignment of a Certificate of Assured Water Supply			
28-	Application for an Analysis of Assured Water Supply			
TOTAL				1,000.00

ERROL L. MONTGOMERY & ASSOCIATES, INC.
PHOENIX ACCOUNT
PH. 480-948-7747
7949 E. ACOMA DR., STE. 100
SCOTTSDALE, AZ 85260

1588

91-527/1221 959

DATE 07-15-05 [redacted]

PAY TO THE ORDER OF The Arizona Department of Water Resources $ 1000.00

One Thousand & xx/100 DOLLARS

Security Features Included. Details on Back.

Wells Fargo Bank Arizona, N.A.
150 N. Stone Ave.
Tucson, AZ 85701
www.wellsfargo.com

FOR 440.21 Application for Analysis of Water Adequacy [redacted] MP

[redacted]

GOLDEN VALLEY 5800 7/27/05

ary 18, 2005

CERTIFICATE OF ASSURED WATER SUPPLY GENERIC DEMAND CALCULATOR

INSTRUCTIONS: This spreadsheet is designed to help you calculate the water demand for your new subdivision for purposes of applying for a Certificate of Assured Water Supply. Please fill out all blue boxes. If you need help, contact the Office of Assured and Adequate Water Supply at (602) 417-2465.

NOTE: This sheet, when completed, does not constitute approval of the demand estimate for your subdivision. It is intended for general estimation purposes only. Final official demand estimates will be determined by the Department upon review of your complete application.

Enter the AMA the subdivision is located in*: tuc

* Enter PHX for Phoenix, TUC for Tucson, PIN for Pinal, PRE for Prescott or SCR for Santa Cruz. If you are not located within an AMA, or are not sure which AMA you are located in, contact the Office of Assured and Adequate Water Supply at (602) 417-2465.

Residential Usage

Category	PPHU	GPCD or per house/day	Demand/HU/YR (af/yr)	No. HU (Lots)	Residential Demand/Yr (af/yr)
Single Family (int)	2.67	57.00	0.17	32000.00	5455.19
Multi-Family (int)		57.00	0.00		0.00
Single Family Landscape (ext)	1.00	118.00	0.13	32000.00	4229.66
Multi-Family Landscape (ext)	0.00	21.00	0.00	0.00	0.00
Single family Demand/HU/YR			0.30		
Multifamily Demand/HU/YR			0.00		

*NOTE: If the application is in the Pinal AMA, and lot sizes are no greater than 10,000 sq. ft., 125 GPCD is used to estimate both interior and exterior demand for single family homes. Do not enter lot numbers under the Landscape rows. Contact the Office of Assured and Adequate Water Supply for more information.

	Square Feet	Acres	Demand Factor (af/yr)	No. HU (Lots)	Large Lot Adjustment Demand/Yr (af/yr)
Average Lot Size (sq. ft)**	7500.00	0.17			
TMP Model Lot Size (sq. ft)	7,500 - 10,000	0.17 - 0.23			
Large Lot Adjustment	0.00	0.00			
1/2 low water use	0.00	0.00	1.50	32000.00	0.00
1/2 turf	0.00	0.00	4.60	32000.00	0.00

**NOTE: If the subdivision contains several groupings of lot sizes, the large lot adjustment needs to be calculated for each grouping of large lot sizes. Contact the Office of Assured and Adequate Water Supply for assistance in calculating the large lot adjustment for subdivisions with several groupings of large lot sizes.

Total Residential Demand **9684.85**

Non-Residential Usage

For each category please enter either square feet or acres of land for that type of non-residential use within your subdivision.

Category	Square Feet	Acres	Demand Factor (af/ac)		Non-Residential Demand (af/yr)
Common Area1		174.00	1.50	low water use	261.00
Common Area2		206.00	4.60	turf	947.60
Right of Way		0.00	1.50	low water use	0.00
Golf Course		110.00	AMA Turf Program - contact AMA		0.00
Commercial use		635.20	2.25	all acres	1429.20
Public Pool (length x width = square feet)		0.00	AMA TMP model	pool	0.00
Parks1		288.60	1.50	low water use	432.90
Parks2		288.60	4.60	turf	1327.56
Retention/Detention Basins		0.00	1.50	low water use	0.00
Retention/Detention Basins		12.60	4.60	turf	57.96
School Landscape1		0.00	1.50	low water use	0.00
School Landscape2		40.50	4.60	turf	186.30
School interior****		4500.00	25 GPCD	interior demand	126.02

***NOTE: If application is for a change of ownership from a previously issued Certificate of Assured Water Supply, and is for only a portion of the original Certificate, contact the Office of Assured and Adequate Water Supply to pro-rate non-residential area acreage.

****NOTE: For school interior demand, enter the number of students. If the proposed school is a high school or middle school, the demand factor is 43 GPCD.

Total Non-Residential Demand **4768.54**

Distribution Losses

	Residential	Non-Residential	Total	Loss Factor %	Distribution Losses (af/yr)
Demand af/yr	9684.85	4768.54	14453.39	10.00	**1445.34**

Construction

	No. of Lots	Demand (gals/lot)	100 yr demand (af)		Construction Demand (af/yr)
	32000.00	10000.00	1216.72		**12.17**

Total Demand Per Year

Residential Usage af/yr	Non-Residential Usage	Lost & Unaccounted for	Construction	Total Non-res	Total Demand Per Year (af/yr)
9684.85	**4768.54**	**1445.34**	**12.17**	**6226.04**	**15910.90**

Residential Usage GPCD	Total Demand GPCD
101	**166**

Annual Build Out Demand

15910.90

January 18, 2005

CERTIFICATE OF ASSURED WATER SUPPLY GENERIC DEMAND CALCULATOR

INSTRUCTIONS: This spreadsheet is designed to help you calculate the water demand for your new subdivision for purposes of applying for a Certificate of Assured Water Supply. Please fill out all blue boxes. If you need help, contact the Office of Assured and Adequate Water Supply at (602) 417-2465.

NOTE: This sheet, when completed, does not constitute approval of the demand estimate for your subdivision. It is intended for general estimation purposes only. Final official demand estimates will be determined by the Department upon review of your complete application.

Enter the AMA the subdivision is located in*: na

* Enter PHX for Phoenix, TUC for Tucson, PIN for Pinal, PRE for Prescott or SCR for Santa Cruz. If you are not located within an AMA, or are not sure which AMA you are located in, contact the Office of Assured and Adequate Water Supply at (602) 417-2465.

[illegible]

Category	PPHU	GPCD or per house/day	Demand/HU/YR (af/yr)	No. HU (Lots)	Residential Demand/Yr (af/yr)
Single Family (int)	2.47	70.00	0.22	[illegible]	5335.88
Multi-Family (int)	[illegible]	57.00	0.15	[illegible]	1380.65
Single Family Landscape (ext)	1.00	125.00	0.14	[illegible]	3396.00
Multi-Family Landscape (ext)	1.00	100.00	0.11	[illegible]	1009.25
Single family Demand/HU/YR			0.36		
Multifamily Demand/HU/YR			0.27		

*NOTE: If the application is in the Pinal AMA, and lot sizes are no greater than 10,000 sq. ft., 125 GPCD is used to estimate both interior and exterior demand for single family homes. Do not enter lot numbers under the Landscape rows. Contact the Office of Assured and Adequate Water Supply for more information.

	Square Feet	Acres	Demand Factor (af/yr)	No. HU (Lots)	Large Lot Adjustment Demand/Yr (af/yr)
Average Lot Size (sq. ft)**	[illegible]	0.17			
TMP Model Lot Size (sq. ft)	7,500 - 10,000	0.17 - 0.23			
Large Lot Adjustment	0.00	0.00			
1/2 low water use	0.00	0.00	1.50	33264.00	0.00
1/2 turf	0.00	0.00	No AMA	33264.00	

**NOTE: If the subdivision contains several groupings of lot sizes, the large lot adjustment needs to be calculated for each grouping of large lot sizes. Contact the Office of Assured and Adequate Water Supply for assistance in calculating the large lot adjustment for subdivisions with several groupings of large lot sizes.

Total Residential Demand 11121.78

[illegible]

For each category please enter either square feet or acres of land for that type of non-residential use within your subdivision.

Category	Square Feet	Acres	Demand Factor (af/ac)		Non-Residential Demand (af/yr)
Common Area1	[illegible]	[illegible]	1.50	low water use	261.00
Common Area2	[illegible]	[illegible]	5.00	turf	1030.00
Right of Way	[illegible]	[illegible]	1.50	low water use	0.00
Golf Course	[illegible]	[illegible]	6.00	6.00	660.00
Commercial use	[illegible]	[illegible]	2.25	all acres	1429.20
Public Pool (length x width = square feet)	[illegible]	[illegible]	AMA TMP model	pool	0.00
Parks1	[illegible]	[illegible]	1.50	low water use	432.90
Parks2	[illegible]	[illegible]	No AMA	turf	0.00
Retention/Detention Basins	[illegible]	[illegible]	1.50	low water use	0.00
Retention/Detention Basins	[illegible]	[illegible]	8.00	turf	100.80
School Landscape1	[illegible]	[illegible]	1.50	low water use	0.00
School Landscape2	[illegible]	[illegible]	5.00	turf	202.50
School interior****	[illegible]	[illegible]	25 GPCD	interior demand	126.02

***NOTE: If application is for a change of ownership from a previously issued Certificate of Assured Water Supply, and is for only a portion of the original Certificate, contact the Office of Assured and Adequate Water Supply to pro-rate non-residential area acreage.

****NOTE: For school interior demand, enter the number of students. If the proposed school is a high school or middle school, the demand factor is 43 GPCD.

Total Non-Residential Demand 2243.00

[illegible]

	Residential	Non-Residential	Total	Loss Factor %	Distribution Losses (af/yr)
Demand af/yr	11121.78	2243.00	13364.78	10.00	1336.48

[illegible]

	No. of Lots	Demand (gals/lot)	100 yr demand (af)		Construction Demand (af/yr)
	33264.00	10000.00	1255.51		12.56

Total Demand Per Year

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11121.78	2243.00	1336.48	12.56	3592.03	14713.81
[illegible]					[illegible]
122					161
[illegible]					
14713.81					

January 18, 2005

CERTIFICATE OF ASSURED WATER SUPPLY GENERIC DEMAND CALCULATOR

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NOTE: This sheet, when completed, does not constitute approval of the demand estimate for your subdivision. It is intended for general estimation purposes only. Final official demand estimates will be determined by the Department upon review of your complete application.

Enter the AMA the subdivision is located in*: PHX

* Enter PHX for Phoenix, TUC for Tucson, PIN for Pinal, PRE for Prescott or SCR for Santa Cruz. If you are not located within an AMA, or are not sure which AMA you are located in, contact the Office of Assured and Adequate Water Supply at (602) 417-2465.

Residential Usage*

Category	PPHU	GPCD or per house/day	Demand/HU/YR (af/yr)	No. HU (Lots)	Residential Demand/Yr (af/yr)
Single Family (int)	2.60	57.00	0.17	1859.00	308.60
Multi-Family (int)		57.00	0.00		0.00
Single Family Landscape (ext)	1.00	178.00	0.20	1859.00	370.66
Multi-Family Landscape (ext)	1.00	77.00	0.09	0.00	0.00
Single family Demand/HU/YR			0.37		
Multifamily Demand/HU/YR			0.09		

*NOTE: If the application is in the Pinal AMA, and lot sizes are no greater than 10,000 sq. ft., 125 GPCD is used to estimate both interior and exterior demand for single family homes. Do not enter lot numbers under the Landscape rows. Contact the Office of Assured and Adequate Water Supply for more information.

	Square Feet	Acres	Demand Factor (af/yr)	No. HU (Lots)	Large Lot Adjustment Demand/Yr (af/yr)
Average Lot Size (sq. ft)**	7600.00	0.17			
TMP Model Lot Size (sq. ft)	7,500 - 10,000	0.17 - 0.23			
Large Lot Adjustment	0.00	0.00			
1/2 low water use	0.00	0.00	1.50		0.00
1/2 turf	0.00	0.00	4.90	0.00	0.00

**NOTE: If the subdivision contains several groupings of lot sizes, the large lot adjustment needs to be calculated for each grouping of large lot sizes. Contact the Office of Assured and Adequate Water Supply for assistance in calculating the large lot adjustment for subdivisions with several groupings of large lot sizes.

Total Residential Demand 679.26

Non-Residential Usage***

For each category please enter either square feet or acres of land for that type of non-residential use within your subdivision.

Category	Square Feet	Acres	Demand Factor (af/ac)		Non-Residential Demand (af/yr)
Common Area1		0.00	1.50	low water use	0.00
Common Area2		0.00	4.90	turf	0.00
Right of Way		0.00	1.50	low water use	0.00
Golf Course		110.00	AMA Turf Program - contact AMA		546.62
Commercial use		317.50	2.25	all acres	714.38
Public Pool (length x width = square feet)		0.00	AMA TMP model	pool	0.00
Parks1		44.35	1.50	low water use	66.53
Parks2		44.35	4.90	turf	217.32
Retention/Detention Basins		0.00	1.50	low water use	0.00
Retention/Detention Basins		0.00	4.90	turf	0.00
School Landscape1		0.00	1.50	low water use	0.00
School Landscape2		0.00	4.90	turf	0.00
School interior****		0.00	25 GPCD	interior demand	0.00

***NOTE: If application is for a change of ownership from a previously issued Certificate of Assured Water Supply, and is for only a portion of the original Certificate, contact the Office of Assured and Adequate Water Supply to pro-rate non-residential area acreage.

****NOTE: For school interior demand, enter the number of students. If the proposed school is a high school or middle school, the demand factor is 43 GPCD.

Total Non-Residential Demand 1544.84

Distribution Losses

	Residential	Non-Residential	Total	Loss Factor %	Distribution Losses (af/yr)
Demand af/yr	679.26	1544.84	2224.10	10.00	222.41

Construction

No. of Lots	Demand (gals/lot)	100 yr demand (af)	Construction Demand (af/yr)
1859.00	10000.00	126.06	1.26

Total Demand Per Year

Residential Usage af/yr	Non-Residential Usage	Lost & Unaccounted for	Construction	Total Non-Res	Total Demand Per Year (af/yr)
679.26	1544.84	222.41	1.26	1768.51	2447.77

Residential Usage GPCD 125

Total Demand GPCD 452

Annual Build Out Demand 2447.77

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY
7949 EAST ACOMA DRIVE, SUITE 100
SCOTTSDALE, ARIZONA 85260 (480) 948-7747
FAX: (480) 948-8737
www.elmontgomery.com
E-MAIL: info@elmontgomery.com

ERROL L. MONTGOMERY, P.G.
WILLIAM R. VICTOR, P.G.
RONALD H. DEWITT, P.G.
MARK M. CROSS, P.G.
DENNIS G. HALL, P.G.
TODD KEAY, P.G.
JAMES S. DAVIS, P.G.
MICHAEL J. ROSKO, P.G.
CHARLES F. BARTER (1937-1999)
DANIEL S. WEBER, P.G.
LESLIE T. KATZ, P.G.

July 15, 2005

RECEIVED
JUL 18 2005
OFFICE OF ASSURED WATER SUPPLY

Mr. Doug Dunham
ARIZONA DEPARTMENT OF WATER RESOURCES
Office of Assured Water Supply
500 N. 3rd Street
Phoenix, Arizona 85004

Dear Mr. Dunham:

Enclosed please find the materials that Errol L. Montgomery & Associates, Inc., has prepared on behalf of American Land Management, LLC, in support of an Analysis of Water Adequacy for the Golden Valley South Master Planned Community in Mohave County, Arizona. The materials include copies of the following documents that we are submitting for your review and approval.

1) Application for Arizona Department of Water Resources (ADWR) Analysis of Water Adequacy

2) Hydrologic Study in Support of the Analysis of Water Adequacy

3) Copies of demand calculations for a lower density and maximum density development utilizing data from ADWR and Mohave County

4) Copies of the preliminary Planned Unit Development

5) A notice of intent to serve as yet incomplete since water company negotiations are underway with various potential providers

6) Ownership documents verifying ownership of all parcels listed in item 3 as belonging to American Land Management, LLC

Although we are aware that not having the water company information finalized can result in delays to a formal application, we do wish to proceed immediately with the Analysis of Water Adequacy.

If you have any questions or require clarification of any documents in the application, please do not hesitate to contact Greg Wallace or me.

Sincerely,

ERROL L. MONTGOMERY & ASSOCIATES, INC.

William R Victor

William R. Victor, P.G.

Enclosures (2 copies)

ARIZONA DEPARTMENT OF WATER RESOURCES
Office of Assured and Adequate Water Supply
2nd Floor, 3550 N. Central Ave., Phoenix, AZ 85012
Telephone (602) 771-8585
Fax (602) 771-8689

Janet Napolitano
Governor

Herbert R. Guenther
Director

COPY

February 17, 2006

Ms. Christine Ballard, Director,
Mohave County Planning and Zoning Department
3675 E. Andy Devine Avenue
Kingman, AZ 86401

RE: Golden Valley Ranch
Phases 1, 2, & 3

Ms. Ballard:

According to the information provided by Stanly Consultants (Stanley) the proposed initial phases of Golden Valley Ranch (Phases 1, 2, and 3) consist of approximately 485 acres and 1,859 single family lots. The provider of the water service is yet to be determined. However, the Department understands that Perkins Mountain Water Company (PMWC) has applied to the Arizona Corporation Commission (ACC) to have its Certificate of Convenience and Necessity (CC&N) expanded to include the Golden Valley Ranch area.

As you may be aware, the department issued an Analysis of Adequate Water Supply to Golden Valley 5800 on October 19, 2005. While the application was for the entire Golden Valley Ranch master plan, the Department could not issue an adequate finding for the entire master plan. The full master plan called for 32,000 single-family lots, golf courses, schools, parks and other common areas, and over 600 acres of commercial uses. The Department determined that this total demand would be nearly 15,000 acre-feet per year (af/yr). Insufficient demonstration of physical availability prevented the Department from issuing the water analysis for the entire master plan. The Department determined, based upon the hydrologic information submitted, that only 9,000 af/yr could be demonstrated to be physically available for 100 years. Legal availability and proof of adequate water quality were not demonstrated on the water analysis.

Using the generic plats provided by Stanley for phases 1, 2, and 3, of Golden Valley Ranch, the Department has completed a rough calculation of projected demands. The Department has made several assumptions on population, landscaping and other factors that will impact the overall demand estimate. The Department included one 18-hole golf course, included approximately half of the projected commercial acreage (317 acres), and made landscaping assumptions on the 89 acres of common area/open space. Using these assumptions and the demand associated with 1,859 lots, the department has calculated the demand to be 2,447 af/yr for phases 1, 2, and 3. This is within the 9,000 af/yr of groundwater demonstrated to be available on the October 2000, analysis.

Please be aware that this is a rough estimate based upon the general plan proposal. This is not the final water adequacy determination as required under statute (A.R.S. §45-108). Demands for the proposed development area will likely be different depending upon the final density and community design. Demands may be reduced with less water intensive landscaping, and other measures such as effluent use in the proposed parks and golf courses. Estimated demands may also increase if other uses the Department is not aware of at this time are included in the subdivision. It should also be noted that the Department could not consider PMWC to be the provider for the proposed development until such time as the ACC approves the final extension of PMWC's Certificate of Convenience and Necessity to cover the proposed development.

If you have any additional questions, please feel free to call me at (602) 771-8590

Sincerely,

Douglas W. Dunham, Manager
Office of Assured and Adequate Water Supply

CC: Steve Olea, ACC
Kristen Keener-Busby, Department of Commerce
Alan Dulaney, ADWR
Tom Whitmer, ADWR

Attachment IV

ATTACHMENT IV

Selected portions from the Golden Valley 5800 (Montgomery, 2005), GVID (Manera, 2006), and Griffith Energy Well Field (Manera, 1998) Reports

PRELIMINARY HYDROLOGIC EVALUATION

GRIFFITH ENERGY WELL FIELD

SACRAMENTO VALLEY, MOHAVE COUNTY, ARIZONA

MANERA INC.
8316 N. 53rd Street
Paradise Valley, AZ 85253

Registered Professional Engineer (Geological)
CERTIFICATE NO
6607
PAUL A.
MANERA
8/3/98

Paul A. Manera

INTRODUCTION

Location of the Griffith Energy Project

The proposed Griffith Energy Project (the "Project")is a natural gas-fired combined cycle electric generating facility to be located ten miles south of the City of Kingman, Mohave County, Arizona, approximately two miles north of the Interstate 40 Griffith interchange.

The proposed site is located on a 160 acre parcel of land (SW¼ of Section 6, T. 19 N., R. 17 W.) within the designated Mohave County I-40 Industrial Corridor. The Industrial Corridor is undeveloped in the vicinity of the Griffith Interchange with the exception of the Praxair industrial complex.

Scope and Purpose of the Study

The scope of this study is to evaluate the available geohydrological data for the purpose of generating a preliminary professional opinion outlining the ground water resources available for development in the area of study. This evaluation entailed determining:

- the hydrological characteristics of the aquifer;
- the movement of the ground water in the aquifer;
- the volume of ground water available in the area around Griffith, and;
- the probable impact of withdrawing ground water at a peak flow rate of 3,300 gpm and an annual average cumulative withdrawal of 3,060 acre feet per annum for consumption throughout the 40-year projected life of the Project.

Area of Study

The proposed location of the well field to withdraw ground water for the I -40 Industrial Corridor industrial complex, with specific emphasis on the development of a water supply for the Griffith Energy Project, comprises Sections 10, 11, 14 and 15, T. 19 N., R. 18 W., as shown on Figure 1.

To properly evaluate the area of the proposed well field, the area of investigation encompassed the northern portion of the Sacramento Valley, with the primary emphasis extending from the Project Site on the east to the Sacramento Wash on the west, and from the Kingman -Oatman Road (Old Route 66) on the north to approximately six (6) miles south of Griffith on the south. These relationships can be seen on Figure 1.

Existing Wells

Two eight (8) inch diameter wells are present in the proposed well field:

- the MCEDA/Praxair well in the southeast corner of Section 10, drilled to a total depth of 800 feet, with a static water level below ground surface ("SWL") of 597 feet;
- the Citizens Utilities Company well in the NE Corner of NW 1/4 of section 14, T. 19 N. R. 18 W., drilled to a total depth of 1,010 feet, with SWL of 605 feet.

Both wells encountered water, and neither well penetrated the total thickness of the alluvial fill, proving the thickness of the alluvium exceeds 1,000 feet in the proposed well field area.

Neither well has been tested; however, the Praxair well is fitted with a pump which will deliver 160 gallons per minute. The Citizens Utilities well has not been equipped.

GEOHYDROLOGY

Geophysical Surveys

Seismic surveys (Gillespie and Bentley, 1971) and a number of electrical resistivity soundings (Turner, 1958, 1966; Manera, 1964, 1967) were made in the Sacramento Valley to measure the thickness of the alluvial deposits.

The seismic surveys conducted by the U. S. Geological Survey utilized conventional refraction methods.

The results of the seismic profile, depicted in Figure 2, run east - west approximately four miles north of the proposed Project well field area, as illustrated on Figure 1, and indicate that the alluvial basin near Griffith is approximately 32,000 feet wide and 4,400 feet deep. The seismic profile implies a sloped bottom to the basin rather than the step faulting that would more commonly be expected to occur.

Layers V_1 and V_2 are both considered to be alluvial fill, with layer V_1 inferred to be the dry portion of the alluvium and layer V_2 the saturated portion of the sediments. It is believed that the water saturating the sediments causes the difference in the seismic velocity readings.

The electrical resistivity soundings indicate that the thickness of the saturated alluvial fill extends below the depth range limitations of the soundings, two thousand (2,000) feet, confirming the fact that the alluvial basins are relatively deep.

These surveys strongly suggest that the saturated thickness of the aquifer is well in excess of one thousand (1,000) feet. The limited drilling, however, has only penetrated the upper four hundred (400) feet of that saturated thickness at the north end of the basin, six hundred (600) feet in the Yucca area, and four hundred (400) feet under the proposed well field, where, in each case, adequate water for the needs of those respective wells was encountered without the need to drill deeper.

Geological Setting

The Sacramento Valley is a fault controlled, intermontane basin of the Basin and Range type of Fenneman (1931), located in the southwestern portion of Mohave County, Arizona. The basin is surrounded by adjacent block faulted mountains consisting of igneous and metamorphic rocks. The mountains forming the boundaries of the basin are the Cerbat Mountains to the northeast, the Hualapai Mountains to the southeast and the Black Mountains to the west.

The Sacramento Valley basin has historically been addressed by reference to three topographic portions, all hydrologically connected: the *northern portion*, locally called Golden Valley, extending from twelve (12) miles north of Highway 68 at the north to six (6) miles north of Yucca on the south; the *middle portion* extending from six (6) miles north of Yucca to the opening between the Black Mountains and Buck Mountain; and the *southern portion*, called Dutch Flat, extending twenty five (25) miles southeast from the opening between the Black Mountains and Buck Mountain; and. The outlet from the basin is through the opening between Buck Mountain and the Black Mountains, through the Franconia narrows extending west from the opening between the Black Mountains and an extension of the Mohave Mountains. These relationships can be seen on Figure 1.

The Sacramento Valley basin was formed in a period of faulting during which blocks of rocks were uplifted and tilted, leaving intervening basins. The blocks between the predominantly northwest - southeast trending faults were not all uplifted an equal amount, thus the basin bottoms and sides are probably a series of stair-step fault blocks. Secondary, northeast - southwest, trending faulting and uplift during this period of movement further complicated the structure of the basins by the formation of deeper to shallower sub-basins within the major basin, causing the width of the basin to vary along the length of the basin. Following and during the structural deformation, erosion from the uplifted blocks and the extrusion of volcanic materials filled the basins with alluvial fill consisting of sands, clays and gravels of sedimentary origin, and tuffs, clays and rocks of volcanic origin.

The geological interpretation of the seismic profiles and electrical resistivity soundings completed in the basin, coupled with the data from Driller's logs of wells drilled in the basin, indicate that the basin is sub-divided into a broad, deep sub-basin (4,400 feet) under the Golden Valley (northern) portion of the basin and a broad, deep sub-basin (greater than 2,000 feet) under the Dutch Flat (southeastern) extension of the basin, separated by a narrower throat at Yucca where the basin is partially filled with a ridge of volcanic rocks appearing, based on limited data at this time, to be non-water-bearing, but covered by layers of alluvial fill ranging in thickness from six hundred (600) feet to more than one thousand (1,000) feet.

The estimated width of the basin aquifer, based on the various data sets available, appears to be:

Golden Valley	- 9 miles or 47,500 feet
Griffith Area	- 6 miles or 32,000 feet
Yucca Area	- 4 miles or 20,000 feet
Dutch Flat	- 8 miles or 42,000 feet
Franconia area	- 2.65 miles or 14,000 feet

The proposed well field would be located in the southern half of the northern (Golden Valley) sub-basin.

Withdrawal from the Aquifer

Prior to 1965, ground water withdrawals from the Sacramento Valley were limited to a few acre feet per year from relatively shallow private wells. In the early 1960's the Duval Copper Company developed the well field now owned and operated by the Cyprus Company for use at the Mineral Park Mine. During the period from 1964 to 1980, an average of 5,645 acre feet per year of water was withdrawn from the Golden Valley portion of the basin aquifer. In 1981, because of scaled back mining operations and consequent reduced water demand, the volume of withdrawal was reduced to 1,935 acre feet per year; and in 1986 the rate of withdrawal was further reduced to five hundred (500) to seven hundred (700) acre feet per year, still primarily for use in the Mineral Park Mine operation (Rascona, 1991).

Currently, withdrawals from the aquifer of the Sacramento Valley are concentrated in two (2) general areas:

- The Golden Valley area had a demand of twelve hundred fifty eight (1,258) acre feet per year in 1990 and is projected to grow to a demand of thirty two hundred forty (3,240) acre feet per year in 2040 (Arizona Department of Water Resources [ADWR], Staff Report, 1994). In addition, ADWR projects that the Cyprus Mineral Park withdrawal, within the Golden Valley portion of the basin, will approach eight hundred (800) acre feet per year for the period 1994 - 2009. This projected volume of withdrawal by Cyprus has not been met during the period 1994 -1998, however. After 2009, the Cyprus Mineral Park operation and ground water withdrawal is expected to be terminated.

- The Yucca area, including the Ford Proving Ground facility and related uses in Yucca, has an estimated withdrawal of one hundred fifty (150) acre feet per year (Miller, 1969).

Little additional withdrawal from the ground water aquifer has been initiated since 1994.

Aquifer Characteristics

The two aquifer characteristics of importance are:

- the specific yield (SY) which is the volume of water that will drain from a unit of a water table aquifer under the force of gravity, stated as a percent of the total volume of the unit; and,

- the transmissivity (T), a measure of the ability of the aquifer to transmit water, expressed in gallons per foot per day.

The specific yield (SY) is an elusive parameter that can only be estimated from observable data, such as the type and shape of the drill cuttings, the homogeneity of the materials in the cuttings, etc. As a result of the conservative nature of most consultants in the field of hydrology, published estimates of specific yield are almost always smaller than the actual field parameters. The transmissivity, on the other hand, can be calculated from the data collected during a properly conducted pumping test or estimated from pumping data; therefore, this value more nearly approaches the actual field value. Although both parameters are not exact, the values are useful in approximating the reaction of the aquifer to the stress of withdrawal.

Transmissivity

Transmissivity (T), the hydrologic conductivity of a unit cross-sectional area of the aquifer, is calculated from properly formatted pumping test data. In the event that the pumping test data is insufficient to calculate the T, or if no test data are available, the value of T can be estimated by multiplying the specific capacity of a well (yield divided by the drawdown) by a coefficient determined from wells for which both specific capacity and transmissivity data were available. This coefficient of proportionality for the Sacramento Valley has been calculated to be 4,400 (Gillespie and Bentley, 1971).

T values ranging from 29,000 gallons per day per foot (gpd/ft) to 37,000 gpd/ft have been calculated or estimated in three wells in the northern portion of the Sacramento Valley (Golden Valley Well No.1, and Cyprus Well No.s 4 and 5). Although there are wells with lower values of T in the northernmost part of the aquifer near the mountain fronts, it can be fairly estimated that typical wells in the center of this portion of the basin will have similar aquifer transmissivity characteristics to those stated above. Therefore, using an average T value of 35,000 gpd/ft for the northern portion of the basin appears reasonable for this report.

A deep well and a moderately deep well are present in the middle portion of the basin in the Yucca area. Neither Driller's log indicated that the well penetrated the complete thickness of the aquifer. The deep well (1000 feet) has an estimated value of T of 120,000 gpd/ft while the moderately deep well (600 feet) has an estimated T value of 26,000 gpd/ft. A T value of 40,000 gpd/ft appears to be a reasonable value for the middle portion of the basin.

Well data is not available for the Dutch Flat portion of the basin.

Based on the present data, it appears that the value of T increases from 35,000 gpd/ft in the northern part of the basin to more than 40,000 gpd/ft in the middle part of the basin.

Using an average value of T = 35,000 gpd/ft for further calculations is believed to be conservative, and would produce computations falling within or below the range of conditions actually occurring in the aquifer throughout the northern and middle portions of the basin. It is expected that the actual field transmissivity will be greater than 35,000 gpd/ft, consequently the actual drawdown impacts that would occur in the aquifer due to the proposed Project, will be less than the projected impacts set forth in this study.

Specific Yield

The specific yield has been estimated as ten (10) percent (Gillespie and Bentley, 1971) and fifteen (15) percent (Turner, 1966). Todd (1980) states that the specific yield of materials range from eight (8) percent for silt up to twenty eight (28) percent for fine grained sand. As the estimate of ten (10) percent by Gillespie and Bentley (1971) falls near the lower end of the range described by Todd (1980), it is believed to be conservative and would produce computations falling within or below the range of conditions actually occurring in the aquifer of the basin.

Water Levels and Slope of the Water Level

Three historical water level maps have been published, 1971 (Gillespie and Bentley), 1979 (Pfaff and Clay) and 1991 (Rascona). Comparison of these three sets of data illustrates three significant conclusions:

- there are virtually no changes in the water levels or the slope of the water levels south of the Kingman - Oatman Road (the proposed area of withdrawal) during the period of recorded data, 1971 -1990;

- a cone of depression was established in the Golden Valley (northern) portion of the aquifer by the withdrawal of 102,000 acre feet of water from the Mineral Park Mine well field during the period 1971 -1994; and,

- the Mineral Park cone of depression is rapidly recovering and has shrunk significantly during the period 1981 - 1998 as a result of the substantial reduction in the rate of withdrawal from the Mineral Park Mine well field, even though other withdrawals have been initiated in the Golden Valley area.

Subsurface Flow and Outflow From the Basin

The subsurface flow of ground water in the aquifer can be calculated by the formula v = TiL, where:

v = volume of flow in gallons per day
T = transmissivity in gpd/ft
i = slope of the water table in feet/foot
L = length of the cross - sectional area of flow in feet;

then the flow of ground water from the northern portion of the basin through the Yucca narrows area when:

i = 250 / 63,360 = .0039 feet per foot

T = 35,000 gpd/ft

L = 20,000 feet

is:

$v = 35{,}000 \times .0039 \times 20{,}000 = 2{,}730{,}000$ gpd

$2{,}730{,}000 / 325{,}851 = 8.378$ acre feet per day

$8.378 \times 365 = 3{,}058$ acre feet per year.

And using the water level contours of Rascona (1991), Plate 1, the total subsurface outflow of both the northern part of the basin (Golden Valley) and the southern part of the basin (Dutch Flat) through Franconia narrows is calculated to be:

$i = 250 / 55{,}000 = .0091$ feet per foot;
(1,300 foot contour to 800 foot contour)

$T = 35{,}000$ gpd/ft;

$L = 14{,}000$ feet;

then:

$v = 35{,}000 \times .0091 \times 14{,}000 = 3{,}882{,}000$ gpd/ft

$3{,}882{,}000 / 325{,}851 = 11.73$ acre feet per day

$11.73 \times 365 = 4{,}281$ acre feet per year.

The calculated outflow of 4,281 acre feet per year based on Rascona's data essentially agrees with the estimated outflow of 4,000 acre feet using the data and calculations of Gillespie and Bentley (1971).

Storage

Gillespie and Bentley (1971) calculated a minimum of 6.5 million acre feet of ground water in storage in the Sacramento Valley aquifer *above 1,500 feet below the surface* and implied that the volume might be twice this minimum amount, or 13 million acre feet.

The Arizona Department of Water Resources (ADWR Staff Report, 1994) estimates the volume of water in storage in the aquifer north of Yucca, *above 1,200 feet below the land surface*, to be 2.3 million acre feet. Considering that ADWR used roughly only seventy five (75) percent of the lateral extent of the saturated aquifer (i.e., only the Golden Valley portion of the aquifer) and only one half the thickness of the aquifer utilized by Gillespie and Bentley, the *minimum* estimates of storage of Gillespie and Bentley and that of the ADWR are remarkably close; however, the actual volume of storage is significantly higher than these estimates if Gillespie and Bentley's *higher* estimate of 13 million acre feet is correct.

Impact of Withdrawal from the Ground Water Aquifer

Griffith Energy LLC/Mayes (1998) stated that the peak flow demand for water for all uses at the Griffith Energy Project would be approximately 3,300 gallons per minute. The year-round expected operating profile projected for the Plant, accounting for projected percentages of base-load operating hours (normal flow demand), maximum output operating hours (peak flow demand), and maintenance and other non-operating hours (minimal flow demand), adjusted for monthly differentials of ambient air temperature and humidity, indicates an actual aggregate annual water requirement of approximately 3,060 acre feet per annum. (Griffith Energy Operations Profile, 1998).

The impact of the proposed withdrawal for a period of forty (40) years was calculated using the simulation model THWells, version 4.01 (van der Heijde, 1996). The calculations of total drawdown are based on the Theis equation for non - steady state flow in an isotropic, homogeneous confined aquifer of infinite extent. The model can be reliably used for water table aquifers, provided the calculated drawdowns are less than half the thickness of the saturated aquifer and a correction factor is applied. In this case, boundary conditions located four and one half (4.5) miles on either side of the well field were simulated using image wells.

For the most conservative analysis, we have assumed a *worst case hypothetical* of maximum peak flow continuously, year-round, which would pump 5323 acre feet.

Simulating a well field of six (6) wells, three (3) wells by two (2) wells, with a spacing of two thousand (2,000) feet between wells, with a continuous withdrawal of 792,000 gallons per day per well for a period of forty (40) years, and including boundary conditions (reflecting the worst case scenario of lateral aquifer extent and continuous peak pumping) gave a calculated maximum drawdown of one hundred and nine and one half (109.5) feet in the pumped wells and a drawdown of less than eighty (80) feet at a radius of one thousand (1,000) feet from the well field.

This projected volume of withdrawal, *which assumes the maximum peak flow demand were pumped continuously for forty (40) years,* would remove 213,000 acre feet from the minimum estimate of 2.3 million acre feet (ADWR, 1994) in storage. This is without considering any of the significant natural recharge to the aquifer that is clearly evidenced by the near-static condition of wells under current withdrawals and the recovery of the Mineral Park Mine cone of depression.

The more realistic projection, however, using the same model and calculations, but with demand figures from the projected actual operating profile and resulting reduced aggregate annual water demand of 3,060 acre feet, but still using assumed worst case boundary conditions, gave a calculated most-likely-case drawdown of 70 feet at the well field, and 40 feet at a radius of one thousand (1,000) feet from the well field. Figures 3, 4, 5 and 6 reflect these two cases, respectively.

Water Quality and Temperature

The results of inorganic chemical analyses of water from Golden Valley Wells 1 and 2, in the northern end of the basin, show a total dissolved solids content of 250 and 280 milligrams per liter (mg/l) respectively. Similar analyses of waters collected at depths of seven hundred (700) feet and nine hundred (900) feet during the drilling program of a test well at Yucca, in the middle portion of the basin, show a total dissolved solids content of 300 mg/l. The results of partial chemical analysis of the Praxair well fall within these parameters. Thus, it appears that the ground waters withdrawn in the proposed well field will fall within the range of 250 mg/l to 300 mg/l.

There have been reports of a more highly mineralized water in the northeastern portion of the basin near the areas being mined in the Cerbat Mountains.

The temperature of the waters from wells in the northern portion of the Sacramento Valley basin were measured at 102 degrees F. in 1991. Reported temperature of the waters from the Praxair well in the southeast corner of Section 10, T. 19 N., R. 18 W. was greater than 102 degrees F. (Lindstrom, 1998) It appears that the waters in the aquifer are above normal temperature for the depths of the aquifer. Thus, it is expected that waters withdrawn from the aquifer in the proposed well field will fall in the temperature range of 102 degrees F. to 105 degrees F.

CONCLUSIONS

The conclusions reached on the basis of the available data are:

- The probability of developing wells capable of yielding between five hundred (500) and eight hundred (800) gallons per minute within the proposed well field (Sections 10 and 15, T. 19 N., R. 18 W.) approaches the ninety eight (98) percent confidence level.

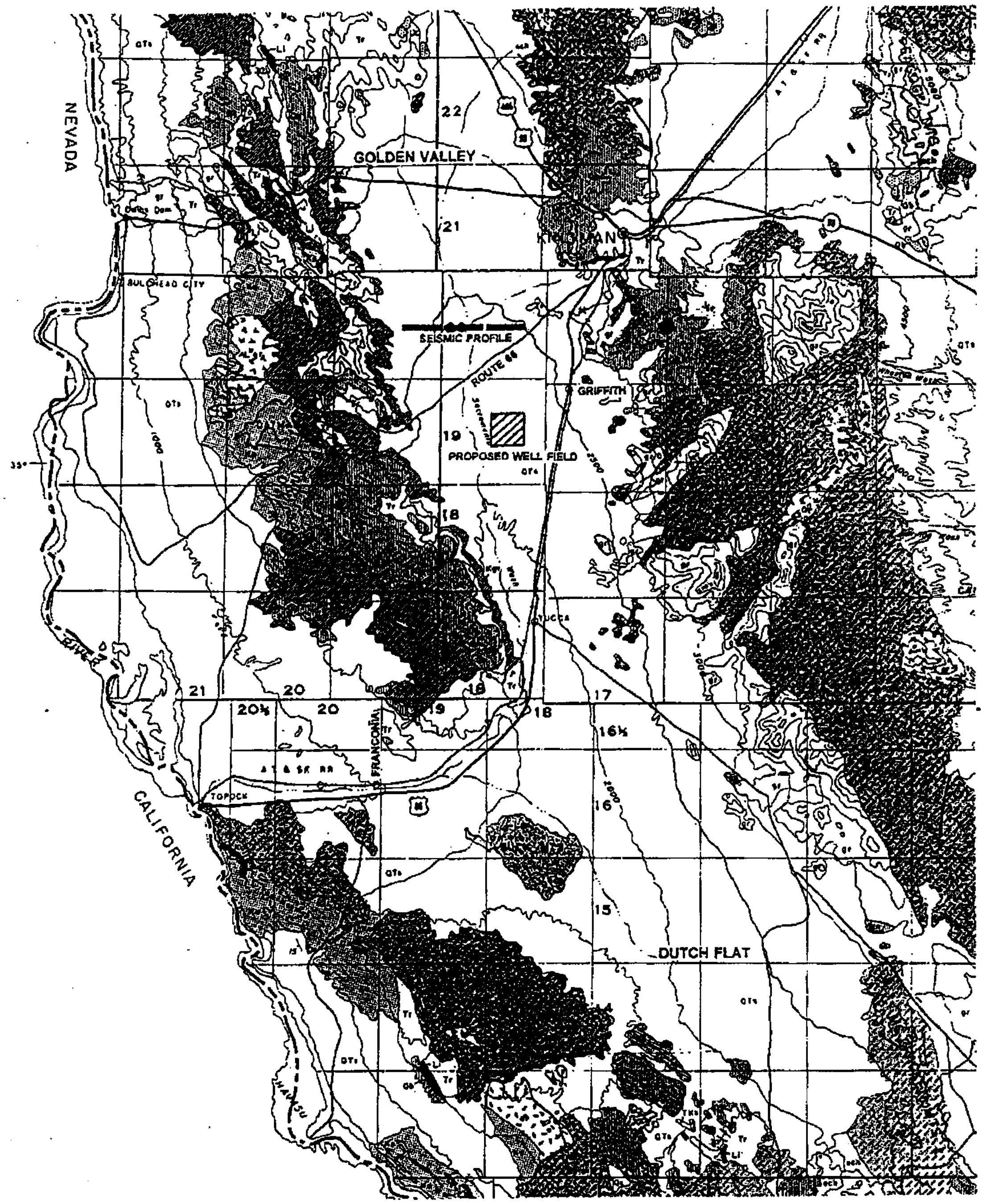
- The capability of withdrawing 5,323 acre feet per year (worst case hypothetical demand) from the ground water reservoir under the proposed well field for a period of forty (40) years appears almost certain; and the projected *actual* demand of 3,060 acre feet per year, virtually certain.

- The probable impact of the *worst case hypothetical* volume of withdrawal for the period of forty (40) years would result in an increase in the pumping depth of one hundred and ten (110) feet in the well field for the Project (approximately a seven hundred foot pumping level) and an eighty (80) foot lowering of the water level one thousand (1,000) feet from the well field. Such a forty (40) year cumulative withdrawal of 213,000 acre feet would constitute nine and one fourth (9.25) percent of the minimum estimate of the 2.3 million acre feet of water in storage in the Golden Valley portion of the Sacramento Valley.

- The probable impact of the *most likely case* volume of cumulative withdrawal for the period of forty (40) years would result in an increase in the pumping depth of sixty (60) feet at the well field for the Project, and a forty-five (45) feet lowering of the water level one thousand (1,000) feet from the well field. And the corresponding forty (40) year withdrawal of 122,400 acre feet would be 5.32% of the minimum aquifer storage estimate.

- The probable water temperature of the water drawn from the ground water reservoir will be in the neighborhood of 102 degrees F.

- The probable total dissolved solids content of the water drawn from the ground water reservoir will approach 300 milligram per liter.



GRIFFITH ENERGY PROJECT

MAP SHOWING THE

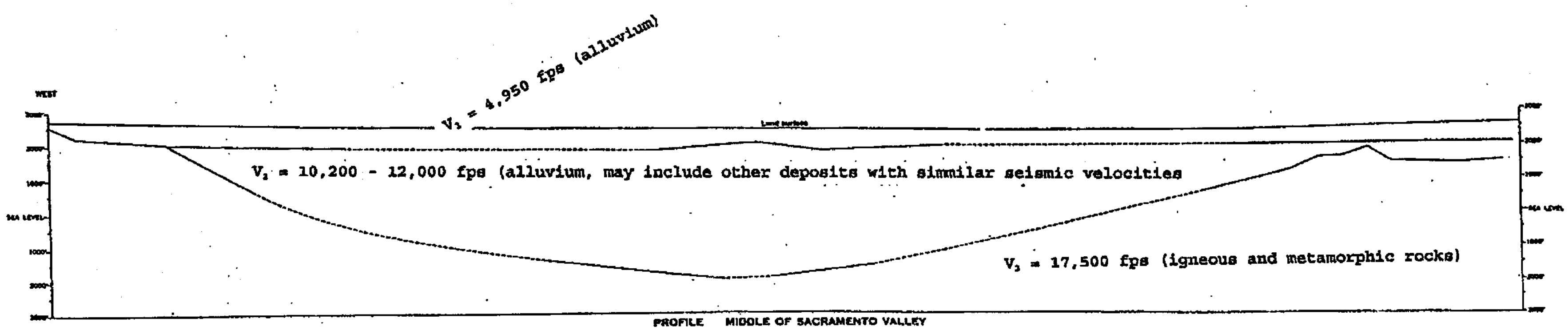
SACRAMENTO VALLEY AND SUBDIVISIONS,

PROPOSED WELL FIELD

AND SEISMIC PROFILE LOCATION

Taken from
Mohave County Geologic Map

FIGURE 1



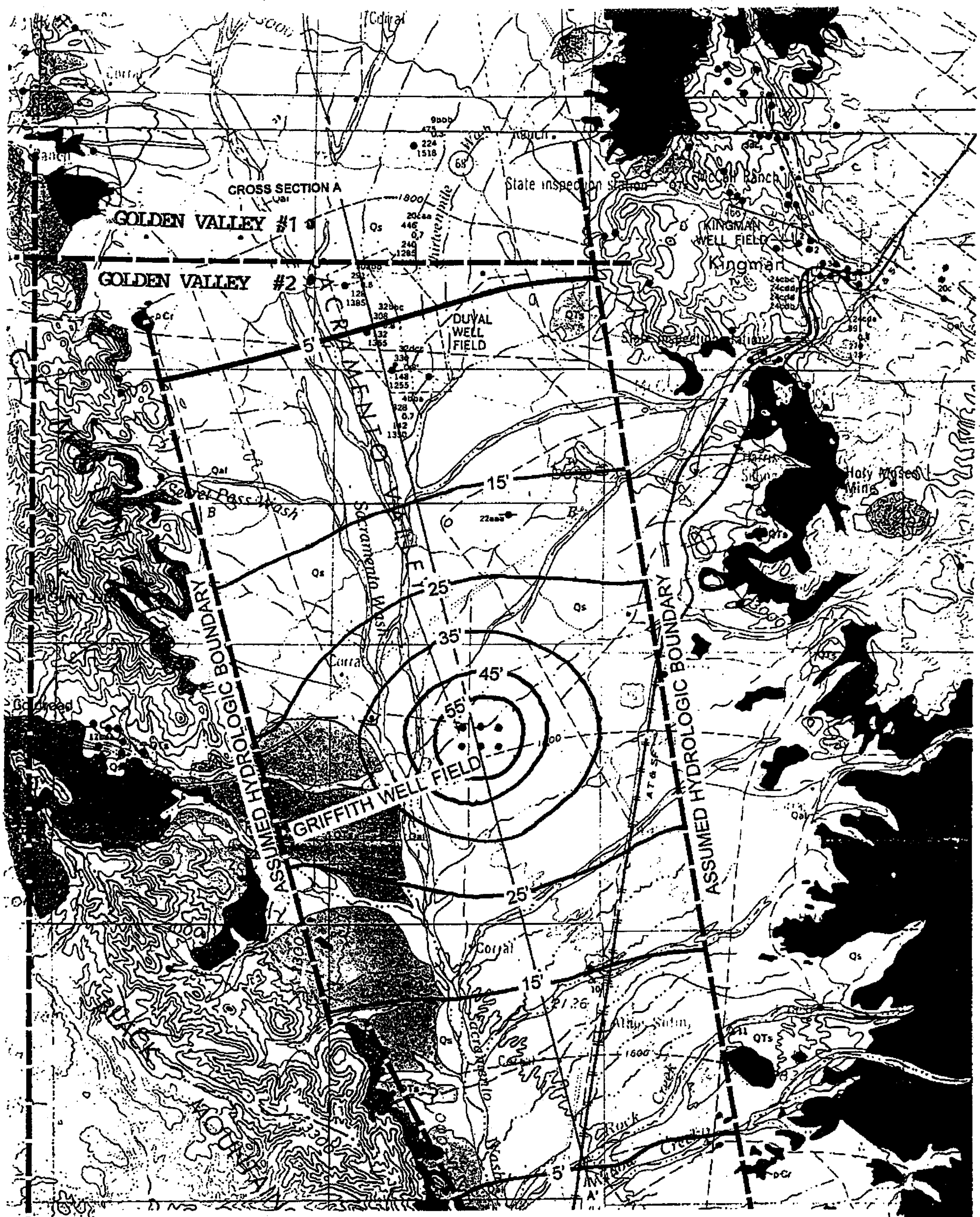
ANALYSIS OF SEISMIC PROFILE ACROSS SACRAMENTO VALLEY,

FOUR MILES NORTH OF GRIFFITH, MOHAVE COUNTY, ARIZONA

Taken from USGS Water
Supply Paper 1899-H

Seismology modified from R. H. Godson,
Branch of Astrogeology, USGS, 1966

FIGURE 2



GRIFFITH ENERGY

PROJECTED WATER LEVEL DECLINES AFTER

FORTY (40) YEARS OF WITHDRAWAL

AT THE RATE OF 792,000 GPD PER WELL, SIX (6) WELLS

BASED ON ESTIMATED AQUIFER PARAMETERS

Figure 3

5323 acft/y

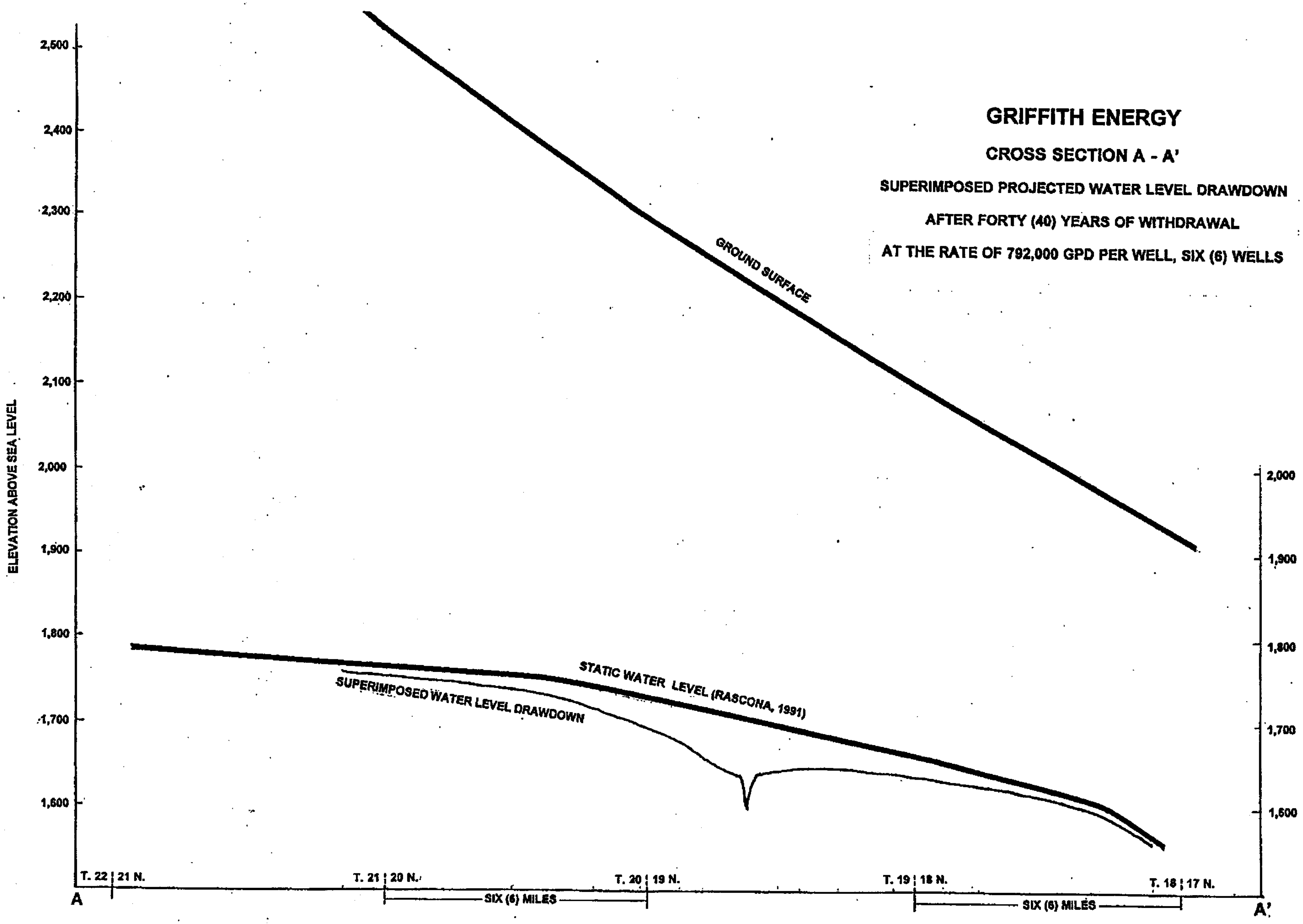
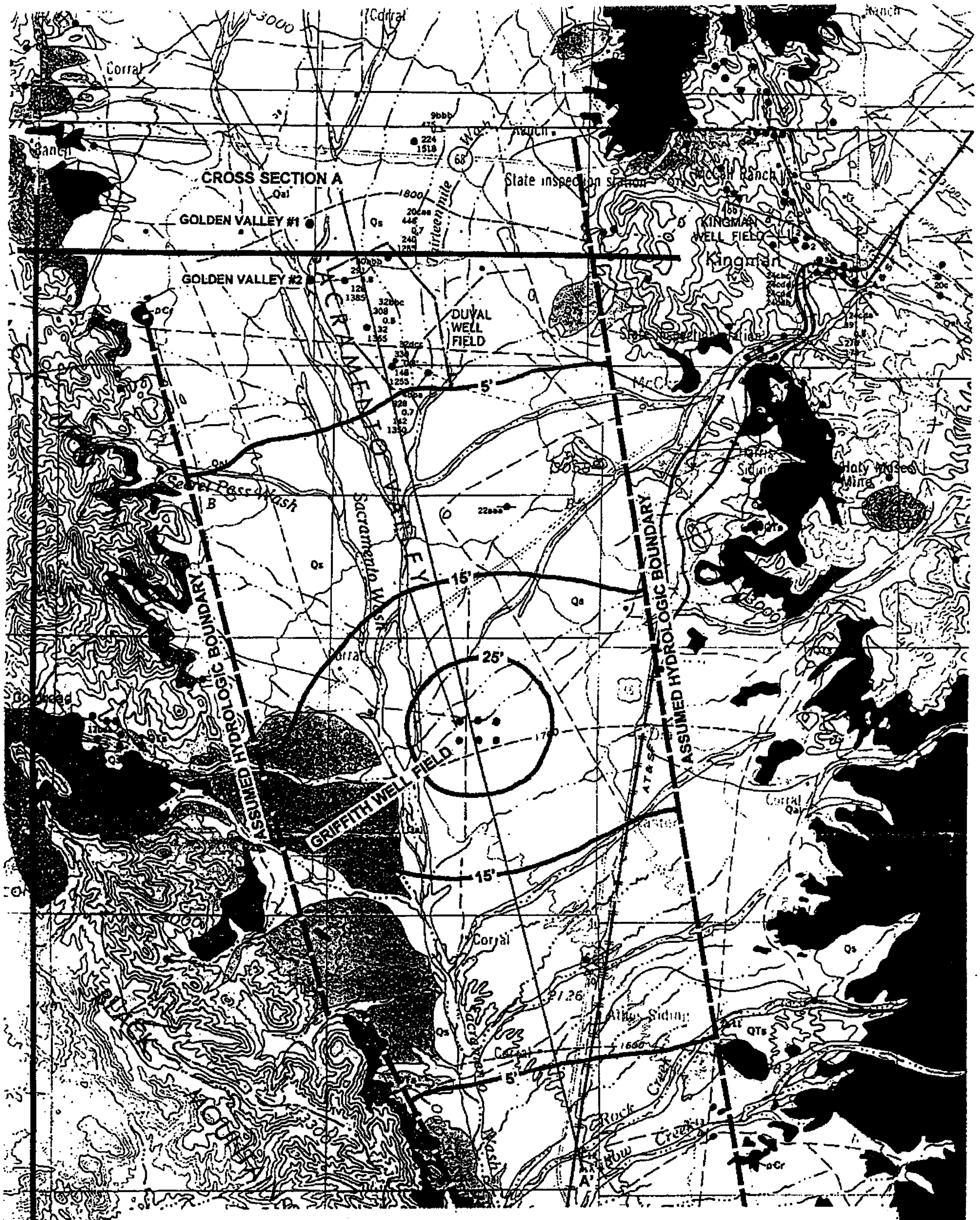

GRIFFITH ENERGY
CROSS SECTION A - A'
SUPERIMPOSED PROJECTED WATER LEVEL DRAWDOWN
AFTER FORTY (40) YEARS OF WITHDRAWAL
AT THE RATE OF 792,000 GPD PER WELL, SIX (6) WELLS
GROUND SURFACE
STATIC WATER LEVEL (RASCONA, 1991)
SUPERIMPOSED WATER LEVEL DRAWDOWN
ELEVATION ABOVE SEA LEVEL
2,500
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
T. 22 | 21 N.
T. 21 | 20 N.
T. 20 | 19 N.
T. 19 | 18 N.
T. 18 | 17 N.
SIX (6) MILES
SIX (6) MILES
A
A'

Figure 4



GRIFFITH ENERGY

PROJECTED WATER LEVEL DECLINES AFTER

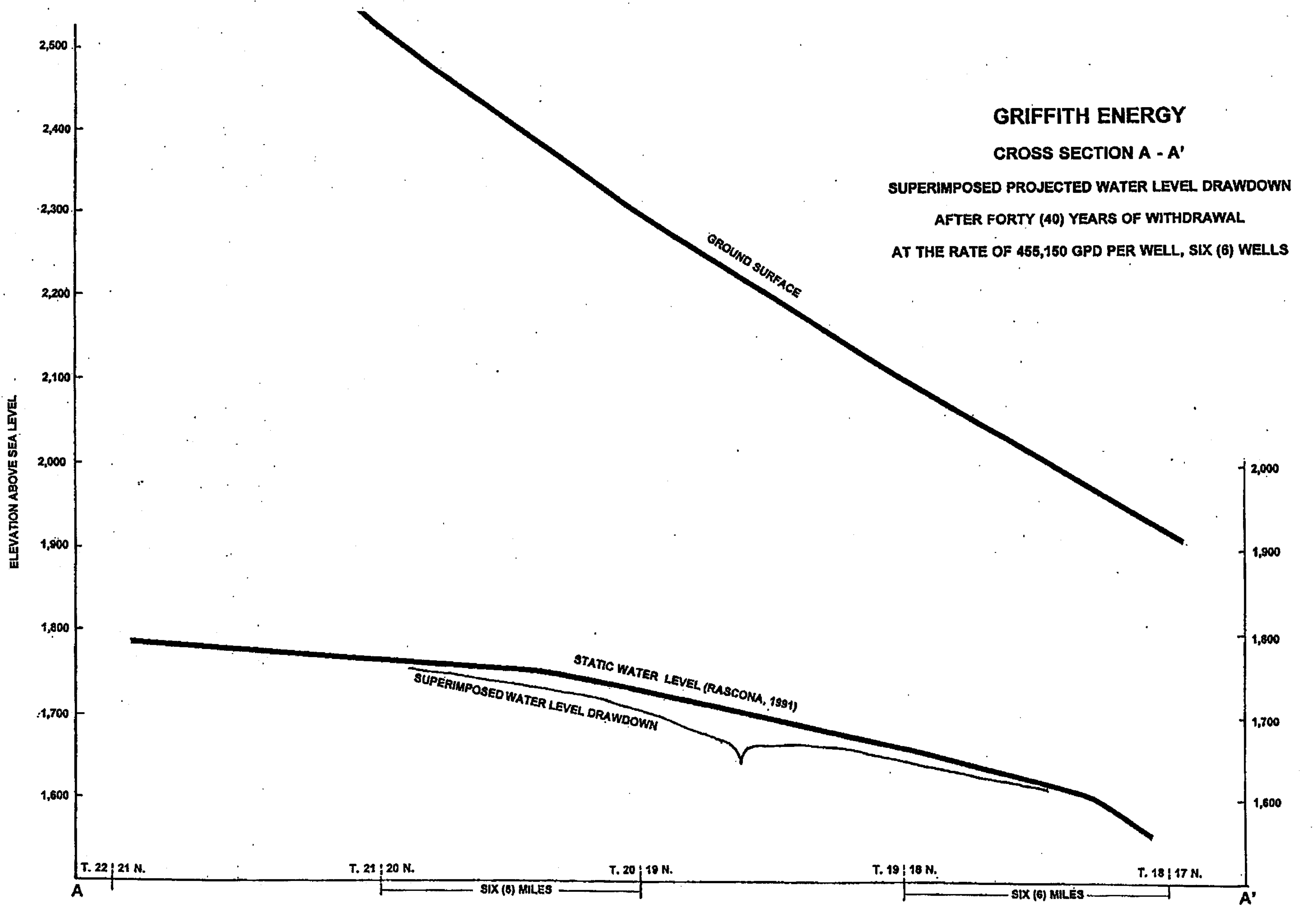
FORTY (40) YEARS OF WITHDRAWAL

AT THE RATE OF 455,150 GPD PER WELL, SIX (6) WELLS

BASED ON ESTIMATED AQUIFER PARAMETERS

Figure 5

3055 acft


GRIFFITH ENERGY
CROSS SECTION A - A'
SUPERIMPOSED PROJECTED WATER LEVEL DRAWDOWN
AFTER FORTY (40) YEARS OF WITHDRAWAL
AT THE RATE OF 455,150 GPD PER WELL, SIX (6) WELLS
ELEVATION ABOVE SEA LEVEL
2,500
2,400
2,300
2,200
2,100
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1,800
1,700
1,600
GROUND SURFACE
STATIC WATER LEVEL (RASCONA, 1991)
SUPERIMPOSED WATER LEVEL DRAWDOWN
T. 22 | 21 N.
T. 21 | 20 N.
T. 20 | 19 N.
T. 19 | 18 N.
T. 18 | 17 N.
SIX (6) MILES
SIX (6) MILES
A
A'
2,000
1,900
1,800
1,700
1,600

Figure 6

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HYDROLOGIC EVALUATION

SACRAMENTO VALLEY

MOHAVE COUNTY, ARIZONA

GOLDEN VALLEY COUNTY IMPROVEMENT DISTRICT No. 1

REPORT

MANERA, INC.
8316 North 53rd Street
Paradise Valley, AZ 85253
480-948-9818

Registered Professional Engineer (Geological)
CERTIFICATE NO.
6607
PAUL A.
MANERA
Date Signed
ARIZONA, U.S.A.

Paul Manera

November 13, 2006

TABLE OF CONTENTS

INTRODUCTION

The Golden Valley County Improvement District No. 1 (GVID) was formed by the Mohave County Board of Supervisors in January 1976. Prior to 1987 no community water sources or facilities were available within the District. An agreement with the Crystal Springs Utility Company in 1987 established a storage - standpipe facility which could deliver approximately 30 gallons per minute. A long range plan for water development and distribution within the District in Phases 1 - 4 was initiated in the late 1980's. Engineering is now in progress on Phases 5 and beyond.

Two wells were drilled to supply the District. Following an evaluation of the ground water availability, the ADWR issued a letter determining that 1,400 acre feet of water would be available in the District (December 4, 1991). The letter stated that the 1,400 acre feet of water would be sufficient for about 6,200 lots at 200 gpd/lot and that 5,405 of those lots were already assigned.

Recent requests for service by multiple developers of property within the District far exceeds the 795 lots remaining, therefore, the District desires to increase the volume of water availability to satisfy these requests. Rather than attempt to determine the exact number of lots requesting service, as in many cases, the preliminary plats will not be started until it is known that water service is available, the District is applying for a designation increase of an additional 6,000 acre feet per year.

The ADWR in a letter dated August 14, 2006, the Department stated that it had determined that 9,000 acre feet per year will be physically and legally available to Golden Valley 5800, per the Department's Analysis of Adequate Water Supply (DWR #23-401823.0000) subject to review of specific restrictions upon the submission of each plat within the project. In effect, the volumes of waters allotted to the GVID (1,400 acre feet per year), Valley Pioneer Water Company (2,810 acre feet per year), the Mine Call (3,000 acre feet per year) and the Golden Valley 5800 (9,000 acre feet per year) and other undocumented demands in the northern portion of the Sacramento Valley, virtually eliminate the possibility of proving additional ground water availability for the GVID under the District.

Consequently, the District has elected to prove that additional ground water is available to the south in the Sacramento Valley approximately six miles south of Griffith and six miles north of Yucca to be moved to the District to satisfy the desired demand of 6,000 acre feet per year.

Location

The Sacramento Valley is a north - south trending basin, approximately twelve miles wide, located west of Kingman between the Cerbat - Hualapai Mountain complex on the east and the Black Mountains on the west in west central Mohave County, Arizona. The valley extends from Chloride on the southern end of the Cerbat Mountains south to the southern end of the Black Mountains four miles south of Yucca. The Sacramento Wash flows southward from the northern end of the valley around the south end of the Black Mountains then turning westward to flow into the Colorado River at Topock. The alluvial portion of the basin is exposed over approximately 360 square miles of the basin. These relationships are illustrated on Figure 1.

The Golden Valley County Improvement District No. 1 encompasses Sections 25 through 29 and 31 through 36, T. 22 N., R. 19 W. and Sections 1 through 5, Sections 8 through 17, Sections 20 through 29 and Sections 31 through 36, T. 21 N., R. 19 W. as illustrated on Figure 6.

Purpose and Scope

The Initial purpose of this study was to determine the quantity of ground water available to support the development of land within the GVID. As it became apparent that additional ground water availability was not present within the District boundaries, the focus of the study changed to determining whether the water availability to the south in the basin was sufficient to satisfy the projected demand of 6,000 acre feet per year

The study was to be completed based upon data available through public sources, i.e. literature, open files of the governmental agencies, private consultant reports available to the public, etc. No additional field work was authorized for this study.

Previous Investigations

Prior to 1960, numerous investigations in the Kingman area were conducted, primarily by personnel of the United States Geological Survey, however, none of these specifically pertained to the ground water conditions in the Sacramento Valley. The first major work concerning ground water in the basin was conducted by Gillespie and Bentley (1971). After 1971, a number of site specific investigations were conducted by Consultants for the development of individual wells. Most of these reports or letters of opinion are not available to the general public. Manera (1991) evaluated the ground water available to the Golden Valley Improvement District and later, the development of the Griffith Energy well field (2000). Montgomery, Errol L. and Associates, Inc., (2005) conducted an investigation of the ground water supply available for the development of Golden Valley 5800.

HYDROGEOLOGY

Rock Types

The rock types present consist of:

various types of volcanic rock which appear to be non-water-bearing in the Black Mountains which form the western edge of the Sacramento basin. The core of the Black Mountain range, consisting of Paleozoic sedimentary and intrusive rocks, are visible only on the western side of the mountains;

primarily granite and metamorphic rock forming the Cerbat - Hualapai Mountains with a small area of Quaternary and Tertiary volcanics in the saddle between the two ranges in the Kingman area. The granitic - metamorphic complex is relatively non-water-bearing. The younger volcanic rocks have proven to be water-bearing and have been exploited to some degree in the Kingman well field, and;

the alluvial fill of the basin between the two mountain ranges which has been divided by ADWR, in the review of the Golden Valley 5800 application, into two portions:

> interbedded alluvium and volcanic rocks along the western front of the Cerbat - Hualapai Mountain complex. This area is water bearing, although the water levels indicate that in some areas the flooded portion of the formation rests upon non-water-bearing rock types at depth, and;
>
> alluvial fill extending to depths exceeding 1,800 feet, which form the primary aquifer of the basin. The total thickness of the alluvial fill has not yet been fully determined by the drill. The alluvium of Quaternary and Tertiary age have been divided into three major units (Gillespie and Bentley, (1971), older, intermediate and younger alluvium of which the older unit is the major aquifer as both the intermediate and younger alluvium are primarily above the water level in the basin. This may not be true in the southern portion of the basin where the water level is 300 feet or less.
>
> The Arizona Department of Water Resources Well Report giving the well characteristics for wells in the Sacramento Valley is included as Appendix A . Representative Drillers' logs of the alluvial fill portion illustrating the types of materials encountered in the subsurface of the basin are included as Appendix B.

<u>Basin Limits</u>

The extent of the exposure of the alluvial fill in the Sacramento Valley is illustrated on Figure 1, a portion of the geologic map of Mohave County. The Arizona Department of Water Resources sub-divided the alluvial basin into two portions;

> the alluvial fill portion of the basin was considered to be the western six mile wide strip along the eastern front of the Black Mountains extending from Highway 68 south to south of Yucca. This portion of the alluvial fill section was defined as that portion of the basin in which the drill cutting logs indicated that the primary subsurface materials were sand, gravel and clay in various forms, i.e. unconsolidated, mildly, moderately or hard consolidation in the form of conglomerate, which the Department considered to be the sole aquifer for the basin, and;
>
> the three mile plus or minus strip along the western front of the Hualapai Mountains was considered to be that portion of the exposed alluvial fill underlain by interbedded layers of alluvium and volcanic rocks of various forms. It was considered that the interbedded formations were not part of the aquifer.

The delineation of the alluvial aquifer, the interbedded alluvial fill and volcanic rocks and the hydrologic boundaries enclosing the aquifer are illustrated on Figure 1. The dividing line between these two divisions of the alluvial fill was considered by ADWR to be the eastern hydrologic boundary in the review of the Golden Valley 5800 study.

Although it is believed that the alluvial aquifer is slightly larger than that delimited by ADWR, the limits set by ADWR will be followed in this study.

Thickness of the Alluvial Fill

Gilllespie and Bentley (1971) estimated the thickness of the 4,400 feet across the middle of the Sacramento Valley, based on geophysical (conventional refractive seismic) evidence.

Although it is expected that the alluvial - bedrock contact is not a smooth curve across the basin, many deep wells were terminated in the alluvial fill, i.e.:

Owner	Well	Total Depth, feet
Standard Metals Corp.	B(17-17)30ddd	1,000 feet;
Mohave County	B(19-18)10daa	1,525 feet;
GVID	B(21-19)13ddd	1,505 feet.

and the Geologic Cross-Section A - A', Figure 2, extending from B(21-19)2ddd to B(21-18)32dcc illustrate that the thickness of the alluvial fill exceeds 1,500 feet in various parts of the basin. The location of Geologic Cross-Section A - A' is shown on Figure 6.

Water Levels

The water levels are relatively flat in the northern end of the basin, ranging from an elevation of 1775 feet north of Highway 68 to 1746 feet twelve miles south at the southern boundary of T. 20 N., R. 18 W. The water level then slopes rapidly south to Yucca where the water level elevation is 1480 feet, a slope of 17.73 feet per mile.

Water levels in the Sacramento Valley basin appear to be in equilibrium at the present time. The fact that the water levels of 2006 are almost identical to those measured by Rascona (1991) and Pfaff and Clay (1981) and is similar to those reported by Gillespie and Bentley (1971) show that few, if any, gross changes have occurred in the past thirty five years. The pumping of the mine wells in T. 21 N., R. 18 W. in the 1960's and 70's generated a limited cone of depression which has virtually disappeared since withdrawal for mining purposes ceased in around 1980.

The water levels in the alluvial center of the basin are illustrated on Figure 3 and the depth to water are illustrated on Figure 4. The trend of the water level in the hydrograph of well B(20-18)22aac, Figure 5, shows a decline of approximately eight feet during the period 1964 - 2004 illustrating that the water levels in the northern portion of the alluvial basin of the Sacramento Valley have remained relatively constant for the last forty years.

Thickness of the Saturated Aquifer

The minimum saturated thickness of the aquifer was calculated by subtracting the total depths of the wells, usually but not always, terminating in the alluvium, from the water level.

The aquifer in the Golden Valley portion of the Sacramento Valley has a saturated thickness ranging from 443 feet, in a well that terminated in bedrock, to more than 575 feet in wells that terminated in alluvial fill. Further south, in the Griffith area, the thickness of the aquifer exceeds 1,000 feet.

Figure 6 illustrates the locations of the calculated thickness.

Water Quality

In general, the water quality from the aquifer(s) within the Sacramento Valley meets the current drinking water standards. Both GVID and the Valley Pioneer Water Company are in compliance with the Department of Environmental Quality as a water providers.

Laboratory analysis of the waters from the Golden Valley 5800 Well GV-1 [B(21-18)3dba] show that the chemical quality of the composite sample taken from the well head during the pumping test meets all the requirements for a "New Source" public water supply (Errol L. Montgomery & Associates, 2005).

No recorded WQARF Superfund sites have been designated in the area of study.

Recharge to the Sacramento Valley

The majority of the recharge to the Sacramento Valley occurs as runoff of the Hualapai Mountains on the eastern side of the basin infiltrating into the alluvial deposits of the valley floor. The flow is then towards the central portion of the basin and southward.

The estimates of the outflow of the basin, and consequently the recharge when the basin is in equilibrium, was calculated at 4,000 acre feet per year (Gillespie and Bentley, 1971, p. H27, Manera, 1994) and 1,000 acre feet per year by Rascona (1991). However, Rascona does not describe the method used to calculate the outflow. Using the slope of the water levels determined by Rascona on his map, 300 feet in seven miles, a width of the outlet measured at 3.4 miles on the surface, constricted to 2 miles in the subsurface and a transmissivity value of 46,000 gpd/ft then:

Transmissivity x slope of water level x width in feet x 365 (year) / 325,851 (gallons per acre foot) = acre feet per year.

$$46{,}000 \times \frac{300}{36{,}960} \times 10{,}560 \times 365 / 325{,}851 = 4{,}416 \text{ ac/ft/yr}$$

which matches the calculations of Gillespie and Bentley (1971) and Manera (1994) of approximately 4,000 ac/ft/yr

Aquifer Parameters

Transmissivity

The values of transmissivity, calculated from pumping tests were taken from various reports calculated by Manera Inc from pumping tests or in one case estimated from the specific capacity of a well (Theis and others pages 331 - 341, in Bentall 1963), in the Sacramento Basin are

Well	Pumping T gpd/ft	Recovery T gpd/ft
B(17-17)9cdd[1]	63,000	
B(17-17)32bcb[2]	52,000	
B(19-18)10aaa	61,983	63 360
B(19-18)10cdd	76 344	
B(19-18)10daa	69,375	42 818
B(19-18)15acc	66 000	44 968
B(19-18)15add	29 106	35 280
B(20-18)4bba[2]	46 000	
B(21-18)32dcc[2]	35,000	
B(21-19)13ddd	17 000	
B(21-19)25aaa	37,000	

[1] calculated from specific capacity
[2] taken from Gillespie and Bentley (1971)

The pumping test and recovery data indicate that the portion of the basin including and south of T 20 N have values of T greater than 43 000 gpd/ft with a majority of the values exceeding 50,000 gpd/ft There is one exception to this range and the recovery data indicates a value of 35 000 gpd/ft

Two of the three wells in T 21 N, R 19 W, which have test reports available have values of T of 35 000 gpd/ft and 37,000 gpd/ft In the remaining well B(21-19)13ddd (GVID Well 1), the value of T = 17 000 gpd/ft was calculated from the first seventy minutes of the pumping test i e the early T_E The pumping levels during the latter fourteen (1 400 minutes) of the test, Figure 7, indicate that value of T_L is much larger than the calculated T_E of 17,000 gpd/ft

The average of the pumping T value is 50 255 say 50,000 gpd/ft and the average of the recovery T values is 46 606 gpd/ft Thus the average value of T = 46,000 gpd/ft used in the model appears reasonable

The value of T = 46 000 gpd/ft is higher than the T value used in the ADWR review of the Golden Valley 5800 model however it is believed the data supports the use of this higher value

Specific Yield

All of the wells used in the model penetrate primarily alluvial materials containing a high percentage of sand and gravels and moderate to minor amounts of clay Therefore it is believed that a specific yield of nine (9) percent is reasonable Model runs using a specific yield of seven (7) percent will be made to project a worst case scenario

There are at several factors which makes the use of the nine (9) percent value for the specific yield viable

> the recharge to the basin was not included in the calculations of drawdown in the simulation model
>
> the eastern hydrologic boundary was established on the basis that wells east of the hydrologic boundary penetrate interbedded layers of alluvial fill and volcanics or only the younger volcanics Regardless of the source rocks these wells yield various amounts of water
>
> consequently the eastern hydrologic boundary has to be a leaky boundary which will allow both the recharge and water draining from aquifers of the various rock types to the east to flow into the "alluvial basin as delimited of the Sacramento Wash as the water level in the Sacramento alluvial basin declines due to withdrawal and
>
> the exact location of the eastern hydrologic boundary was determined by the location of wells containing subsurface volcanics in the drill cutting logs The separation of the wells does not allow an exact delineation of the hydrologic boundary therefore, It is possible that the alluvial basin could be slightly wider than stated, allowing a larger storage area than delimited It is unlikely that the delimited alluvial basin would be smaller

SIMULATION MODELING

Method of Calculating Drawdown

The simulation model utilized for this study was THWells ver 4 01 (van der Heijde 1996) The program THWells calculates the drawdown of piezometric head due to the combined effect of up to 100 discharge wells in a confined leaky-confined or unconfined aquifer The calculations of the total drawdown, in this case are based on the Theis equation for non-steady state flow in an isotropic homogeneous confined aquifers with a correction applied for water table aquifers Boundary effects can be included through the use of image well theory

In this case the number of wells was 19 discharge points within the alluvial aquifer with 19 image well discharge points west of the alluvial basin and 19 image well discharge points east of the alluvial basin for a total of 57 discharge points to simulate the two hydrologic boundaries of the alluvial basin

It is understood that there are inherent weaknesses in the model as designed, including the fact that the aquifer had to be considered a isotropic homogeneous formation, however the model is as good or better than a more sophisticated model design considering the limited volume of data available to establish the aquifer characteristics

Although this is a relatively simple model the field data is sufficient to generate "good results

Calculation - Description of Withdrawal

The volume of withdrawal was based on the volume of the designation of the Water Company or the approved volume of ground water allotted to a proposed subdivision or the projected industrial use of the I-40 (Griffith) Industrial Corridor The volume allotted to the designated areas are

Golden Valley Improvement District	1 400 acre feet per year
Valley Pioneer Water Company	
8 300 lots at 0,32 ac/ft/lot	2 656 acre feet per year
Non-residential parcels	155 acre feet per year
Mine call	3,000 acre feet per year
Golden Valley 5800	9,000 acre feet per year
I-40 Corridor	
Praxair	20 acre feet per year
MTC Prison	200 acre feet per year
Wal-Mart	180 acre feet per year
Griffith Energy, 2,396 96 ac/ft/yr/35 years	839 acre feet per year

The GVID, the Valley Pioneer Water Company the Mine call and Golden Valley 5800 have fixed amounts of water allotted to the entity

The I-40 Corridor water demands were determined in the following manner

The Praxair, the MTC Prison and Wal Mart water demands were the values given by the entity

The Griffith Energy facility has a projected life of 40 years The plant has been in operation for a period of five years The present owners of the Griffith Energy Plant calculated the use of 2 396 96 acre feet per year for the next 35 years based on

100 million gallons per day for the months of June, July August and September

75 million gallons per day for the months of October November December April and May and,

2 million gallons per day for January, February and March.

The 35 year usage of 83,894 acre feet was then spread over the 100 year period of the simulated withdrawal yielding 839 ac/ft/yr.

The total I-40 Corridor well field then had a projected withdrawal of 1,239 acre feet per year.

The total volume of withdrawal was then apportioned to the number of wells operated in each entity.

Simulated Withdrawal from Basin

Withdrawal of ground water from the alluvial basin, used in the simulation model, was based on the complete build out as of January 1, 2007. The volume of withdrawal was the volume allocated by some form of an adequate water supply designation by the ADWR, plus the projected demand of the I-40 Industrial Corridor near Griffith and the 6,000 acre feet per year requested by virtue of this report and application.

The location of wells, ADWR I.D. Number and the committed volume of withdrawal, as of October 2006, from each well used in model are:

Present Designations or Demands:

Golden Valley Improvement District		1,400 ac/ft/yr
B(21-19)13ddd	55-530666	624,960 gpd
B(21-19)25aaa	55-530665	624,960 gpd
Valley Pioneer Water Company, including the Mine call		5,810 ac/ft/yr
B(21-18)20dbb	55-623084	1,296,631 gpd
B(21-18)30bba	55-623082	1,296,631 gpd
B(21-18)32bbb	55-623083	1,296,631 gpd
B(21-18)32dcc	55-623081	1,296,631 gpd
I-40 Industrial Corridor	(100 year basis)	1,239 ac/ft/yr
B(19-18)15acc	55-574436	276,527 gpd
B(19-18)10cdd	55-571367	276,527 gpd
B(19-18)10aaa	55-580149	276,527 gpd
B(19-18)10daa	55-574434	276,527 gpd
Golden Valley 5800		9,000 ac/ft/yr
B(20-18)4aaa		1,339,114 gpd
B(20-18)8bbb		1,339,114 gpd
B(20-18)8ccc		1,339,114 gpd

B(21-18)9bbb	1,339,114 gpd
B(20-18)15ccc	1,339,114 gpd
B(20-18)15ddd	1,339,114 gpd

Application to be Filed

Proposed Yucca Well Field:	6,000 ac/ft/yr
B(18-18)11baa	1,785,485 gpd
B(18-18)12bcd	1,785,485 gpd
B(18-18)13bdd	1,785,485 gpd

<u>Model Design</u>

The model utilized for the analysis of the drawdown in water levels was THWells, ver. 4.01. The origin of the model grid was located at the northwest corner of T. 21 N., R. 20 W. G&SR B&M. Townships 17 through 21 North., Ranges 17 through 20 West were included in the grid so as to include the alluvial portion of the Sacramento Valley extending from Highway 68 south to Yucca and the areas of the image wells.

The model design was:

grid interval	5280 feet in both the x and the y directions;
transmissivity	46,000 gallons per day per foot;
specific yield	7 percent (.07) and 9 percent (.09)
aquifer thickness	500 feet
well locations:	
production	given in Table 1
image	given in Table 1
volume of withdrawal:	
GVID	1,400 acre feet per year
Valley Pioneer Water Co.	2,810 acre feet per year
Mine call	3,000 acre feet per year
I-40 Industrial Corridor	1,239 acre feet per year
Golden Valley 5800	9,000 acre feet per year
Yucca Well Field	4,000 and 6,000 acre feet per year

The Golden Valley Improvement District wells, the Valley Pioneer Water Company wells and the I-40 Corridor wells used in the model are presently in place. Not all of the existing wells owned by those entities were utilized in the model, however, the total projected production for each entity was divided among the wells used.

The wells used in the model for withdrawal by the Golden Valley 5800 project and the proposed Yucca Well Field for Golden Valley Improvement District are theoretical wells. These well locations are approximate and the location of the wells may be moved based on land acquisition.

TABLE 1

GOLDEN VALLEY IMPROVEMENT DISTRICT

SACRAMENTO VALLEY BASIN WELLS AND IMAGE WELL LOCATIONS

Well Location	x	y	*Model I.D.*	x	y	*Model I.D.*	x	y	*Model I.D.*
GVID									
B(21-19)13aaa	62,832	15,840	*1*	25,608	31,680	*3*	80,784	7,920	*5*
B(21-19)25aaa	62,832	21,120	*2*	29,832	35,376	*4*	84,480	12,408	*6*
VALLEY PIONEER									
B(21-18)20dbb	71,280	18,744	*7*	21,648	39,864	*11*	76,560	16,632	*15*
B(21-18)30bba	66,792	21,648	*8*	26,928	38,280	*12*	82,368	15,048	*16*
B(21-18)32bbb	69,696	26,928	*9*	25,872	44,088	*13*	84,480	20,592	*17*
B(21-18)32dcc	71,808	31,416	*10*	30,888	48,840	*14*	86,064	25,344	*18*
RHODES Theoretical									
B(20-18)4bbb	77,352	32,208	*19*	27,984	53,856	*25*	83,424	30,096	*31*
B(20-18)8bbb	71,808	38,016	*20*	35,376	53,856	*26*	91,344	28,512	*32*
B(20-18)8ccc	71,808	42,504	*21*	38,016	56,496	*27*	93,456	32,736	*33*
B(20-18)9bbb	77,088	38,544	*22*	31,416	57,288	*28*	87,120	33,792	*34*
B(20-18)9ccc	77,088	42,240	*23*	35,112	60,456	*29*	90,816	36,960	*35*
B(20-18)16ccc	77,088	47,520	*24*	38,280	63,888	*30*	94,512	39,600	*36*

TABLE 1, Page 2

Well Location	x	y	*Model I.D.*	x	y	*Model I.D.*	x	y	*Model I.D.*
I-40 CORRIDOR									
B(19-18)10aaa	86,064	69,168	*37*	47,520	86,064	*41*	104,808	61,512	*45*
B(19-18)10cdd	83,952	74,448	*38*	51,744	87,648	*42*	108,768	63,360	*46*
B(19-18)10daa	86,064	71,808	*39*	49,104	87,648	*43*	105,600	63,360	*47*
B(19-18)15acc	84,480	77,088	*40*	53,328	89,760	*44*	110,880	65,736	*48*
YUCCA									
B(18-18)11baa	88,176	105,072	*49*	69,696	112,464	*52*	117,744	101,376	*55*
B(18-18)12bcd	94,512	102,960	*50*	64,416	115,632	*53*	111,408	100,840	*56*
B18-18)13bdd	94,512	109,824	*51*	68,640	120,384	*54*	112,464	107,712	*57*

Model Runs and Results

Eight model runs were completed with the THWells results included as Appendices C through J and plotted as Plates 1 through 8. Each run was for 100 years starting in the year 2007 and ending in 2107. Each run assumed complete build out with its attendant demand as of January 1, 2007.

Although not a committed or requested demand for residential use, the I-40 Industrial Corridor projected use of 1,239 acre feet per year was included in all runs.

The eight runs were subdivided into four scenarios (cases) with a specific yield of seven (7) percent and nine percent (9) in each scenario.

Case 1 existing conditions or designations

Plate 1 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .07 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr.

Plate 2 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .09 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr.

Result in Case 1 (Plates 1 and 2)

the drawdown caused by the withdrawal of a total of 7,211 acre feet per year from the wells of the Golden Valley Improvement District and the Valley Pioneer wells in the northern end of the basin and 1,239 acre feet per year at Griffith (I-40 Industrial Corridor) would result in a decline in the water level of approximately one and one half foot per year in the extreme northern end of the basin around the wells in the southwest portion of T. 21 N., R. 18 W. and one half foot per year in the Griffith area. The difference caused by the difference in specific yield is relatively small in this case.

Case 2 the existing conditions of Case 1 plus the additional withdrawal of 9,000 acre feet per year for Golden Valley 5800.

Plate 3 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .07 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr and the Requested Demand for Golden Valley 5800 = 9,000 ac/ft/yr.

Plate 4 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .09 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr and the Requested Demand for Golden Valley 5800 = 9,000 ac/ft/yr.

Result In Case 2 (Plates 3 and 4) the decline caused by 16,211 acre feet in the northern end of the basin and the 1,239 acre feet per year at Griffith (I-40 Industrial Corridor) would result in a decline in the water level:

ranging up to 4 feet per year in the concentrated well field in the northern end of the basin and 1.5 feet per year at Griffith when the specific yield was .07;

slightly more than 3 feet per year in the concentrated well field in the northern end of the basin and 1 foot per year at Griffith when the specific yield was .09, and;

Case 3 the conditions of Case 2 plus an additional withdrawal of 4,000 acre feet per year at the proposed Yucca Well Field in T. 18 N., R. 18 W.

Plate 5 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .07 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr and the Requested Demand for Golden Valley 5800 = 9,000 ac/ft/yr and the Proposed Yucca Well Field = 4,000 ac/ft/yr.

Plate 6 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .09 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr and the Requested Demand for Golden Valley 5800 = 9,000 ac/ft/yr and the Proposed Yucca Well Field = 4,000 ac/ft/yr.

Result In Case 3 (Plates 5 and 6) the decline caused by 16,211 acre feet in the northern end of the basin, 1,239 acre feet per year at Griffith (I-40 Industrial Corridor) and 4,000 acre feet per year at the proposed Yucca Well Field would result in a decline in the water level:

ranging from 2 feet up to 5 feet per year around one well near the eastern hydrologic boundary in the concentrated well field in the northern end of the basin, 1.75 feet per year at Griffith and 1.25 feet per year at the Yucca Well Field when the specific yield was .07;

ranging from 2 feet up to slightly more than 3.5 feet per year around one well near the eastern hydrologic boundary in the concentrated well field in the northern end of the basin, one foot per year at Griffith and 1.2 feet per year at the Yucca Well Field when the specific yield was .09;

Case 4 the conditions of Case 2 plus an additional withdrawal of 6,000 acre feet per year at the proposed Yucca Well Field in T. 18 N., R. 18 W.

Plate 7 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .07 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr and the Requested Demand for Golden Valley 5800 = 9,000 ac/ft/yr and the Proposed Yucca Well Field = 6,000 ac/ft/yr.

Plate 8 Water Level Declines in 100 Years When T = 46,000 gpd/ft and SY = .09 for the committed demand of GVID = 1,400 ac/ft/yr, Valley Pioneer Water Company = 2,811 ac/ft/yr and the Mine Call = 3,000 ac/ft/yr and the Requested Demand for Golden Valley 5800 = 9,000 ac/ft/yr and the Proposed Yucca Well Field = 6,000 ac/ft/yr.

Result In Case 4 (Plates 7 and 8) the decline caused by 16,211 acre feet in the northern end of the basin, 1,239 acre feet per year at Griffith (I-40 Industrial Corridor) and 6,000 acre feet per year at the proposed Yucca Well Field would result in a decline in the water level:

ranging from 2 feet up to 5 feet per year around one well near the eastern hydrologic boundary in the concentrated well field in the northern end of the basin, 2 feet per year at Griffith and 1.6 feet per year at the Yucca Well Field when the specific yield was .07;

ranging from 2 feet up to slightly more than 3.5 feet per year around two wells near the eastern hydrologic boundary in the concentrated well field in the northern end of the basin, 1.75 foot per year at Griffith and 1.6 feet per year at the Yucca Well Field when the specific yield was .09;

CONCLUSIONS

The Sacramento Valley basin is capable of yielding:

the 1,400 acre feet per year committed to the Golden Valley Improvement District;

the 2,810 acre feet per year committed to the Valley Pioneer Water Company;

the 3,000 acre feet per year for the Mine Call;

the 1,239 acre feet per year demand of the I-40 Industrial Corridor;

the 9,000 acre feet per year application for Golden Valley 5800, and;

the 6,000 acre feet per year requested in this application, to be transported to the GVID area in the northern portion of the basin;

for the next 100 years based on a value of transmissivity of 46,000 gallons per day per foot and a specific yield of either seven percent or nine percent.

The thickness of the saturated aquifer in the northern end of the basin, that portion called Golden Valley, ranges from 443 feet to more than 575 feet, thus the drawdown does not exceed the saturated thickness. Further, although the model indicates that the water level will decline 500 feet around one well in the concentrated well field in the northern portion of the basin, there are a number of mitigating circumstances which will restrict the water level from declining to that depth during the 100 year period defined for this study:

1. the model runs were all based on complete build out on January 1, 2007, whereas at this time:

    a. the Golden Valley Improvement District has an allotment for 6,200 lots but is serving only 1,380 meter connections for a withdrawal of 317 acre feet per year;
    b. Valley Pioneer Water Company has an allotment for 8,300 lots but is serving only 2,072 meter connections with a withdrawal of 537 acre feet per year;
    c. Golden Valley 5800 has not yet started ground water withdrawal, but may be approved for approximately 20,000 lots, and;
    d. the I-40 Industrial Corridor will not be at full withdrawal for another two years.

    As it is unlikely that complete build out will be complete for at least 25 plus years, the volume of withdrawal will be significantly less than stated in the model;

2. the recharge of approximately 4,000 acre feet per was not included in the model which will add 400,000 acre feet of water to the aquifer over the next 100 years;

3. there are numerous producing wells east of the eastern hydrologic boundary of the defined alluvial aquifer, indicating a minor aquifer in the alluvial - volcanic inter-bedded formation to the east of the defined alluvial aquifer. As the water level in the defined alluvial basin decline, ground water from the minor aquifer to the east will flow through the delimited hydrologic boundary into the defined alluvial basin, increasing the recharge rate to the alluvial aquifer, and;

4. finally, as the mine call is dependent on the economics of copper, the mine call may not be a continuous withdrawal of the 3,000 acre feet per year for the next 100 years. In the past 60 years withdrawal from the ground water reservoir for the mine was in effect only 26 years..

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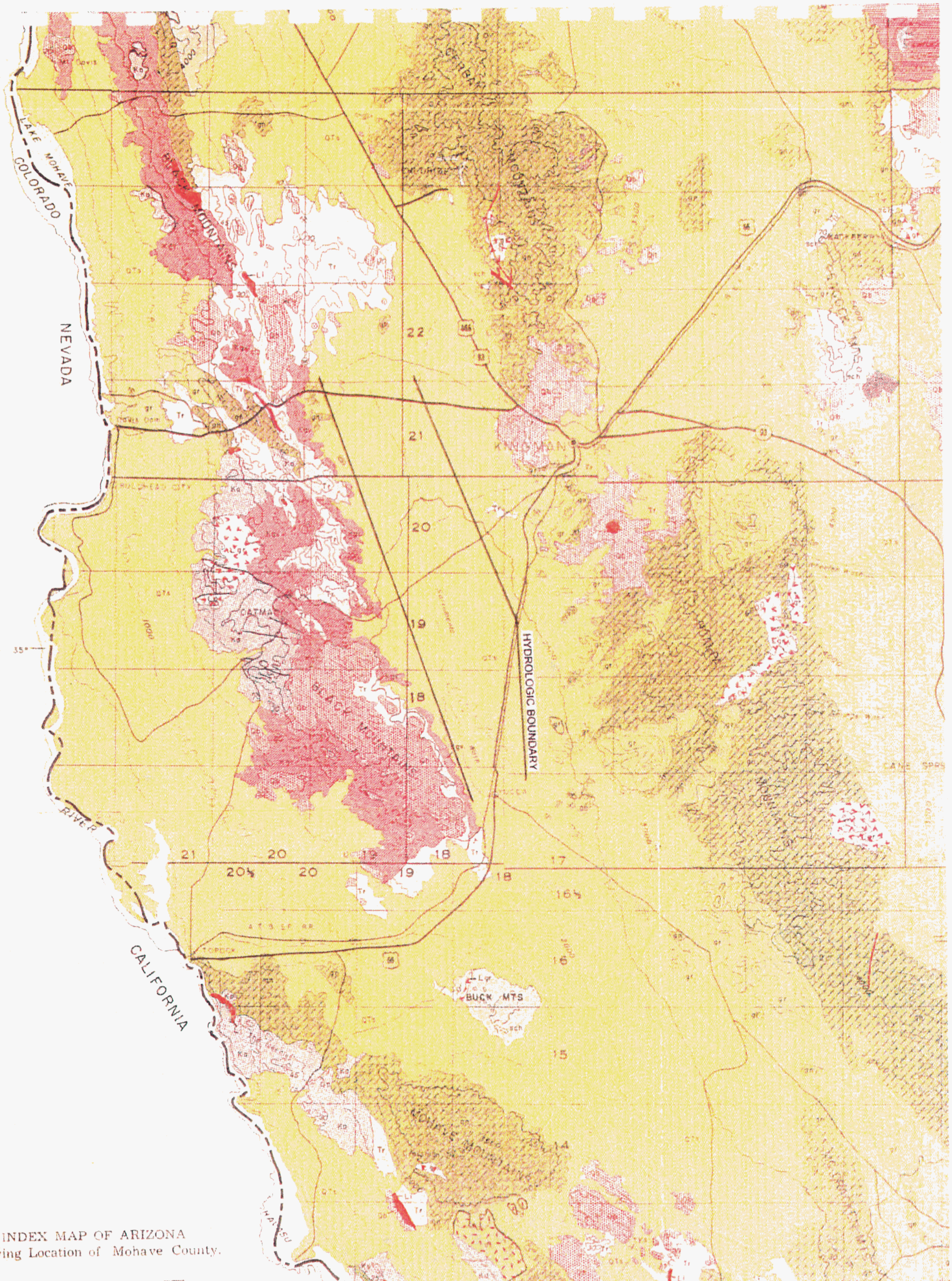
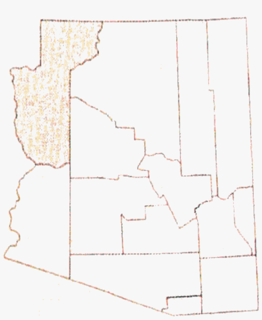
FIGURES 1 - 7



INDEX MAP OF ARIZONA
Showing Location of Mohave County.



GEOLOGIC MAP OF THE SOUTHWESTERN PORTION OF MOHAVE COUNTY

SHOWING THE HYDROLOGIC BOUNDARIES OF THE ALLUVIAL BASIN OF THE SACRAMENTO VALLEY AS ESTABLISHED BY ADWR

SCALE: 1 inch = 6 miles

FIGURE 1

Taken from: The Geologic Map of Mohave County, Arizona
Wilson, E. D. et al., 1959

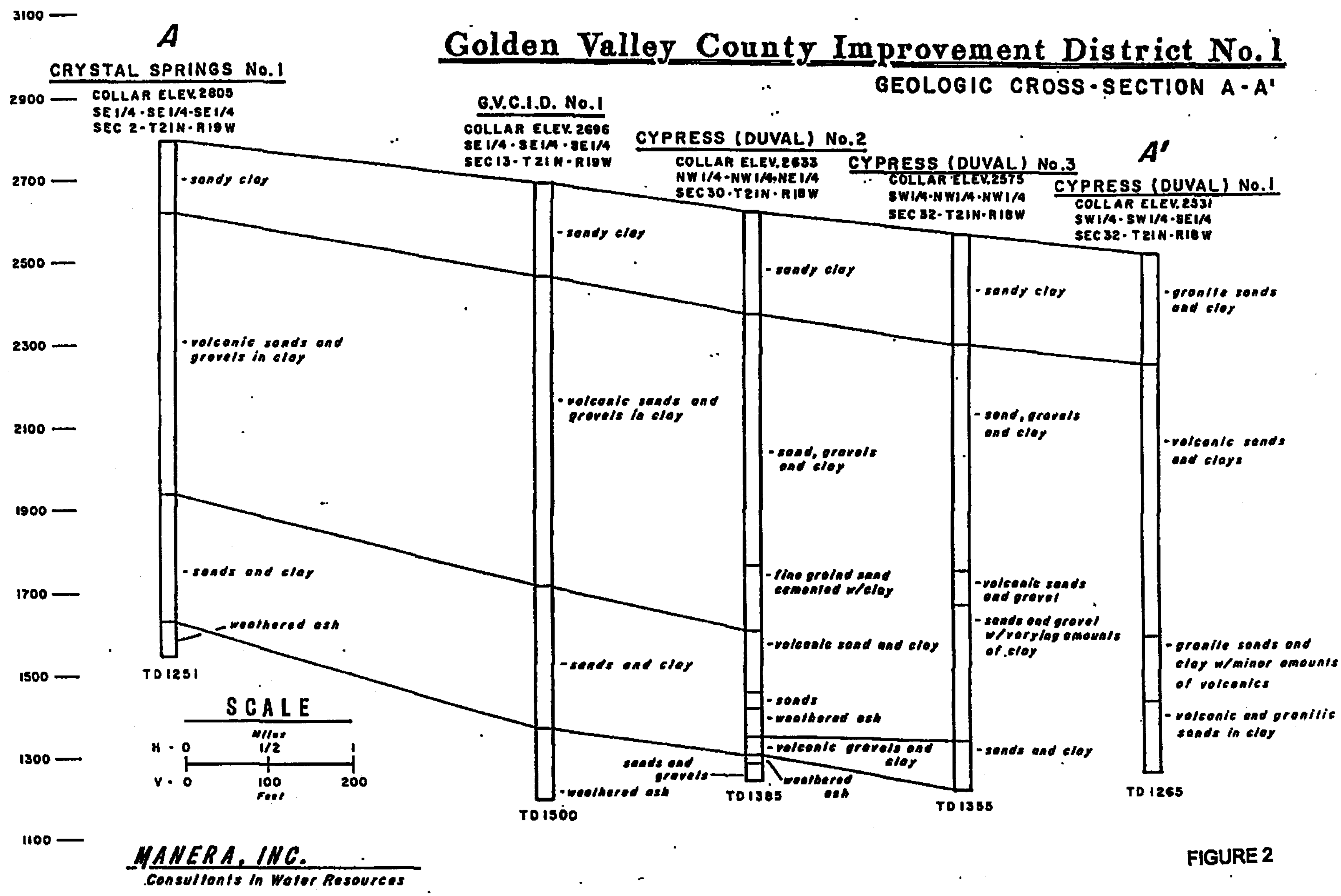
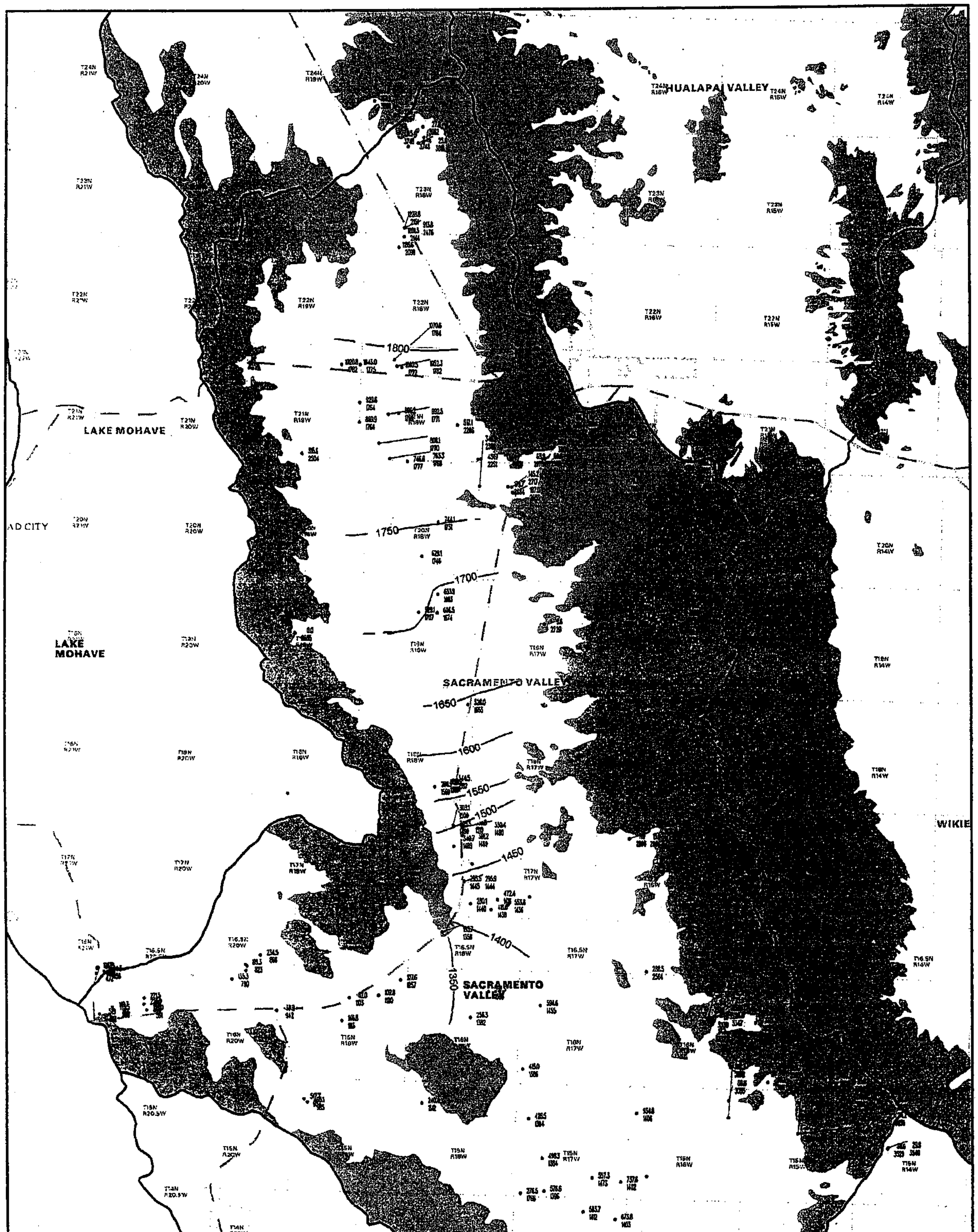

Golden Valley County Improvement District No. 1
GEOLOGIC CROSS-SECTION A-A'
3100
2900
2700
2500
2300
2100
1900
1700
1500
1300
1100
A
CRYSTAL SPRINGS No. 1
COLLAR ELEV. 2805
SE 1/4-SE 1/4-SE 1/4
SEC 2-T21N-R19W
-sandy clay
-volcanic sands and gravels in clay
-sands and clay
-weathered ash
TD 1251
G.V.C.I.D. No. 1
COLLAR ELEV. 2696
SE 1/4-SE 1/4-SE 1/4
SEC 13-T21N-R19W
-sandy clay
-volcanic sands and gravels in clay
-sands and clay
-weathered ash
TD 1500
CYPRESS (DUVAL) No. 2
COLLAR ELEV. 2633
NW 1/4-NW 1/4-NE 1/4
SEC 30-T21N-R18W
-sandy clay
-sand, gravels and clay
-fine grained sand cemented w/clay
-volcanic sand and clay
-sands
-weathered ash
-volcanic gravels and clay
sands and gravels
weathered ash
TD 1385
CYPRESS (DUVAL) No. 3
COLLAR ELEV. 2575
SW 1/4-NW 1/4-NW 1/4
SEC 32-T21N-R18W
-sandy clay
-sand, gravels and clay
-volcanic sands and gravel
-sands and gravel w/varying amounts of clay
-sands and clay
TD 1355
A'
CYPRESS (DUVAL) No. 1
COLLAR ELEV. 2531
SW 1/4-SW 1/4-SE 1/4
SEC 32-T21N-R18W
-granite sands and clay
-volcanic sands and clays
-granite sands and clay w/minor amounts of volcanics
-volcanic and granitic sands in clay
TD 1265
SCALE
Miles
H - 0 1/2 1
V - 0 100 200
Feet
MANERA, INC.
Consultants in Water Resources

FIGURE 2



Hardrock

Wells Measured

Townships

Subbasins

Basins

Depth to Water

Water Level Elevation

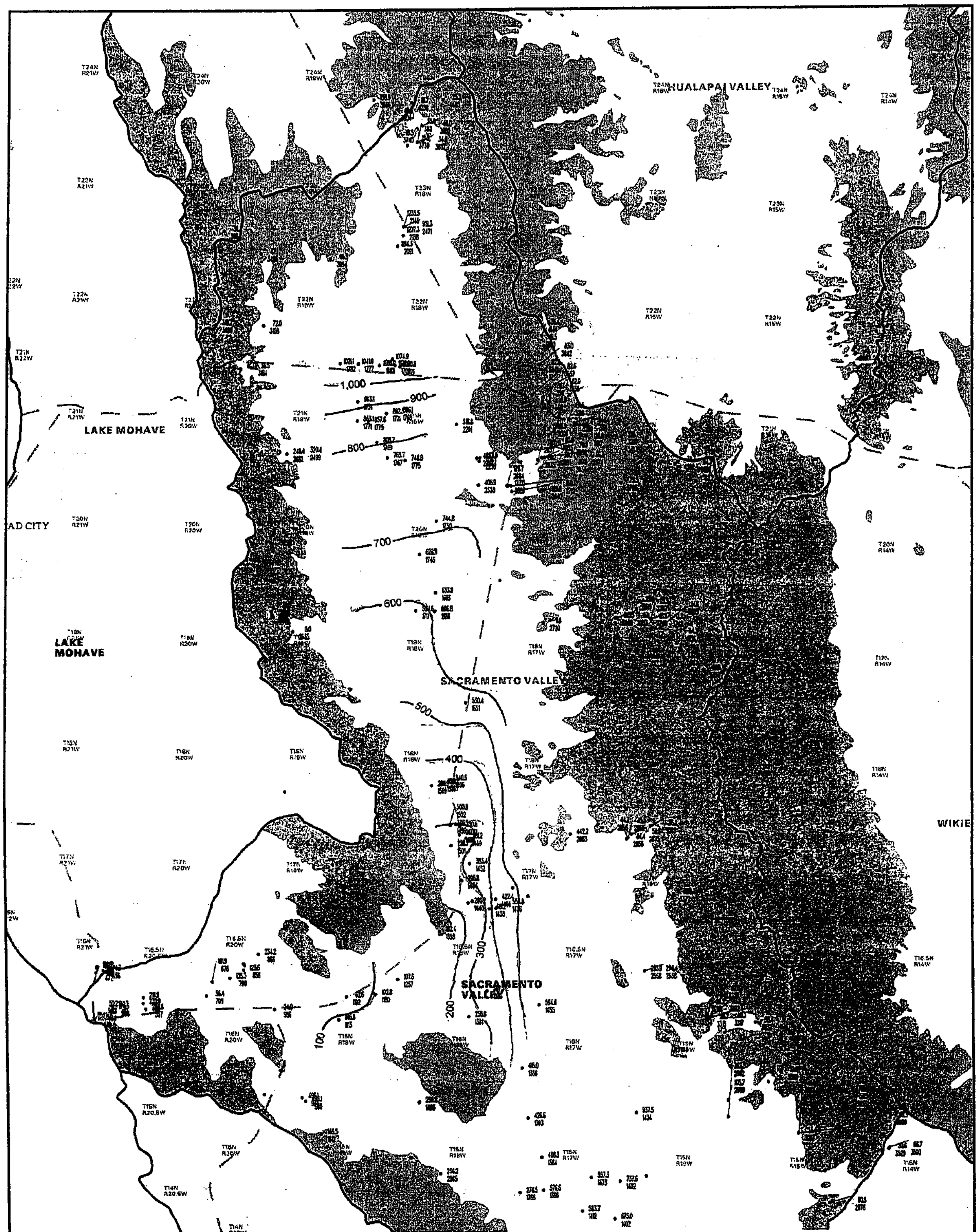
SACRAMENTO VALLEY

WATER LEVEL ELEVATIONS BETWEEN

JANUARY 2000 AND JANUARY 2006

Base and Data Taken From the Open Files
Arizona Department of Water Resources

FIGURE 3



Hardrock

Wells Measured

Townships

Subbasins

Basins

Depth to Water

Water Level Elevation

SACRAMENTO VALLEY

DEPTH TO WATER

JANUARY 2000 AND JANUARY 2006

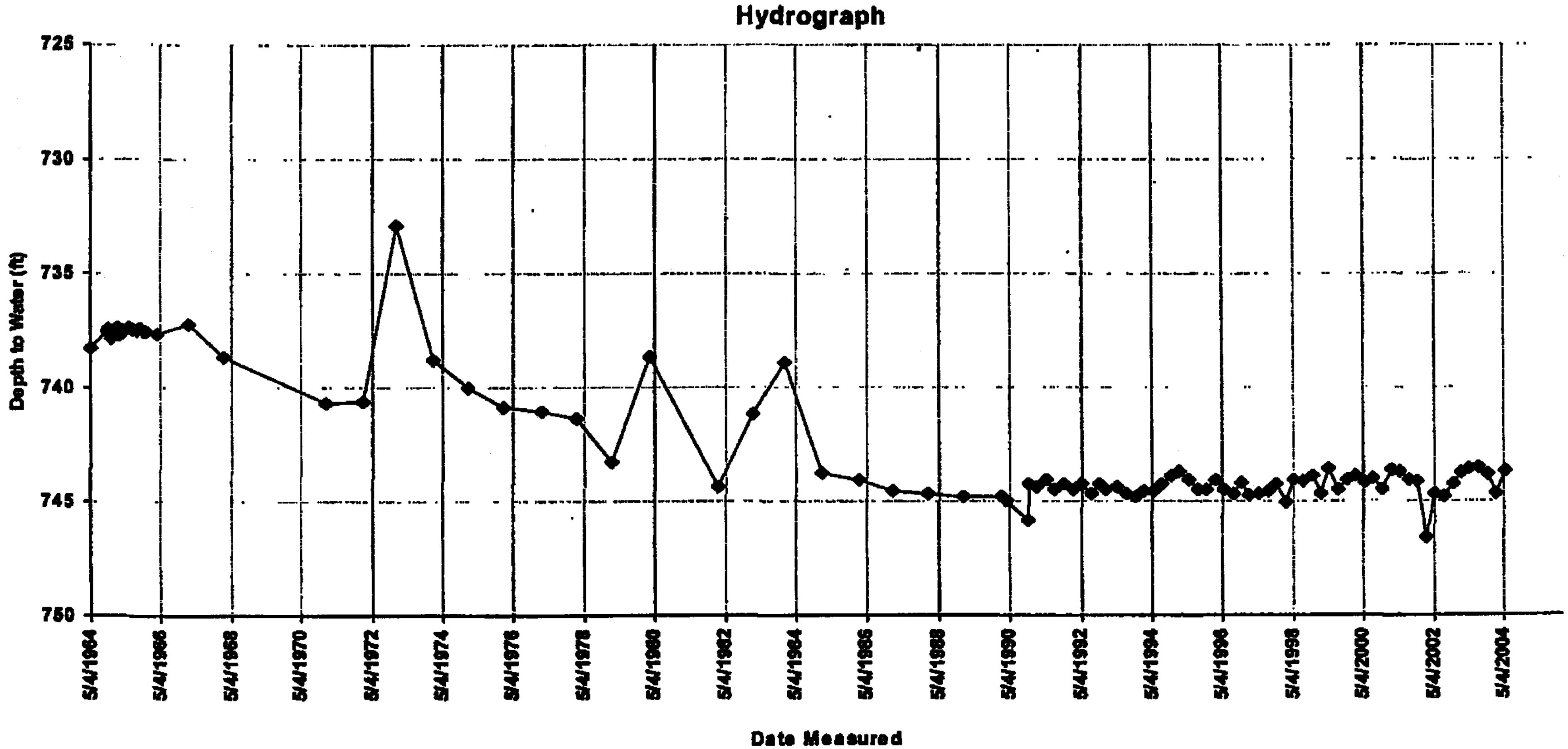
Base and Data Taken From the Open Files
Arizona Department of Water Resources

FIGURE 4

GWSI Well Report and Hydrograph

AZ Dept of Water Resources

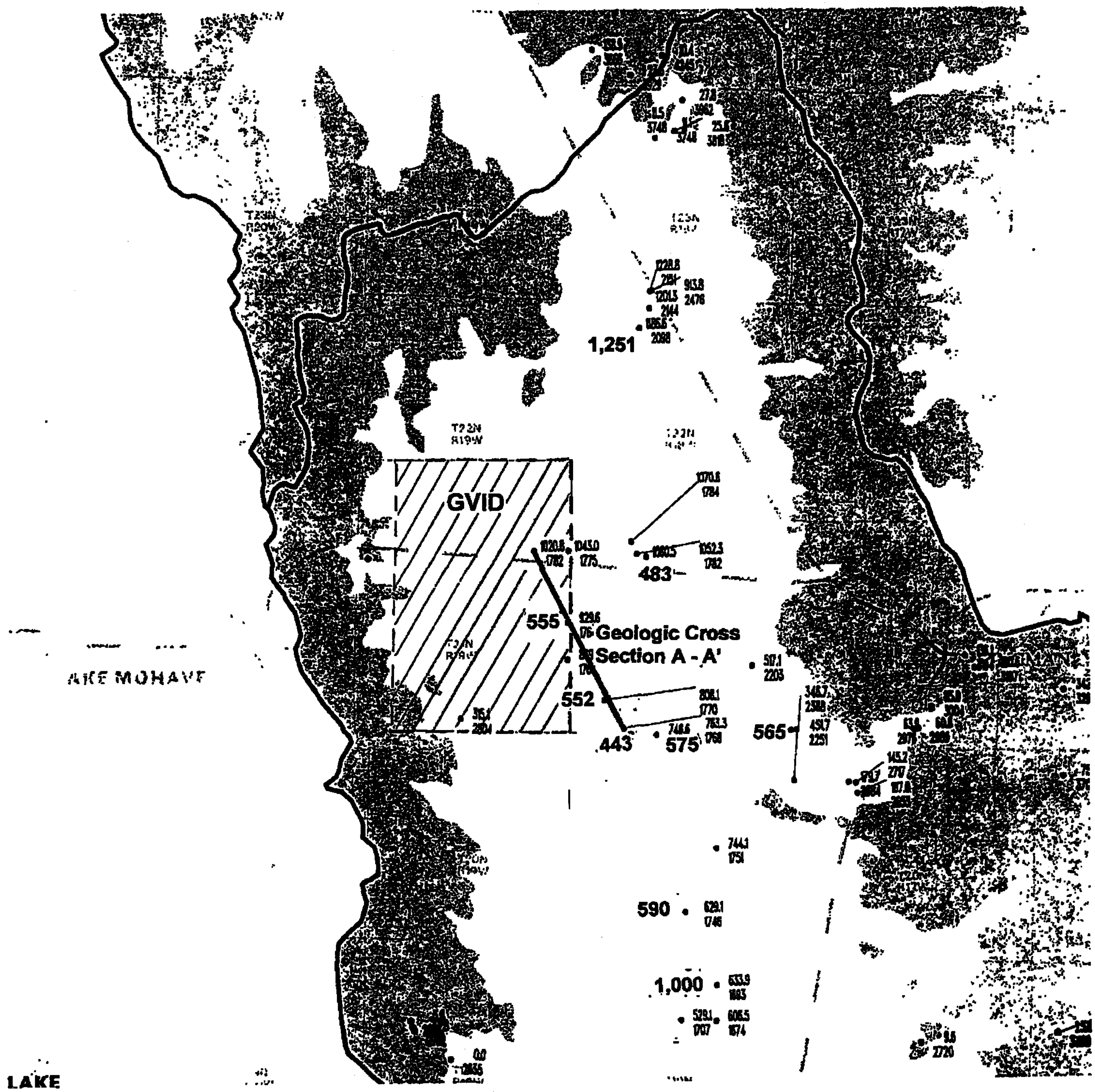
Local ID	Site ID	ADWR Reg. No.	Latitude	Longitude	Water Uses	Well Depth	Drill Date	Case Dia.	Latest WL Date	Depth to Water	WL Alt. above Mean Sea Level	Times Meas.
B-20-18 22AAC	350633114103701		35° 6' 33.59''	114° 10' 36.29''	UNUSED	779			5/11/2004	743.75	1751.25	95



GWSI is ADWR's technical database of well locations, construction data, and water levels.

Thursday, October 26, 2006

FIGURE 5



NORTHERN SACRAMENTO VALLEY

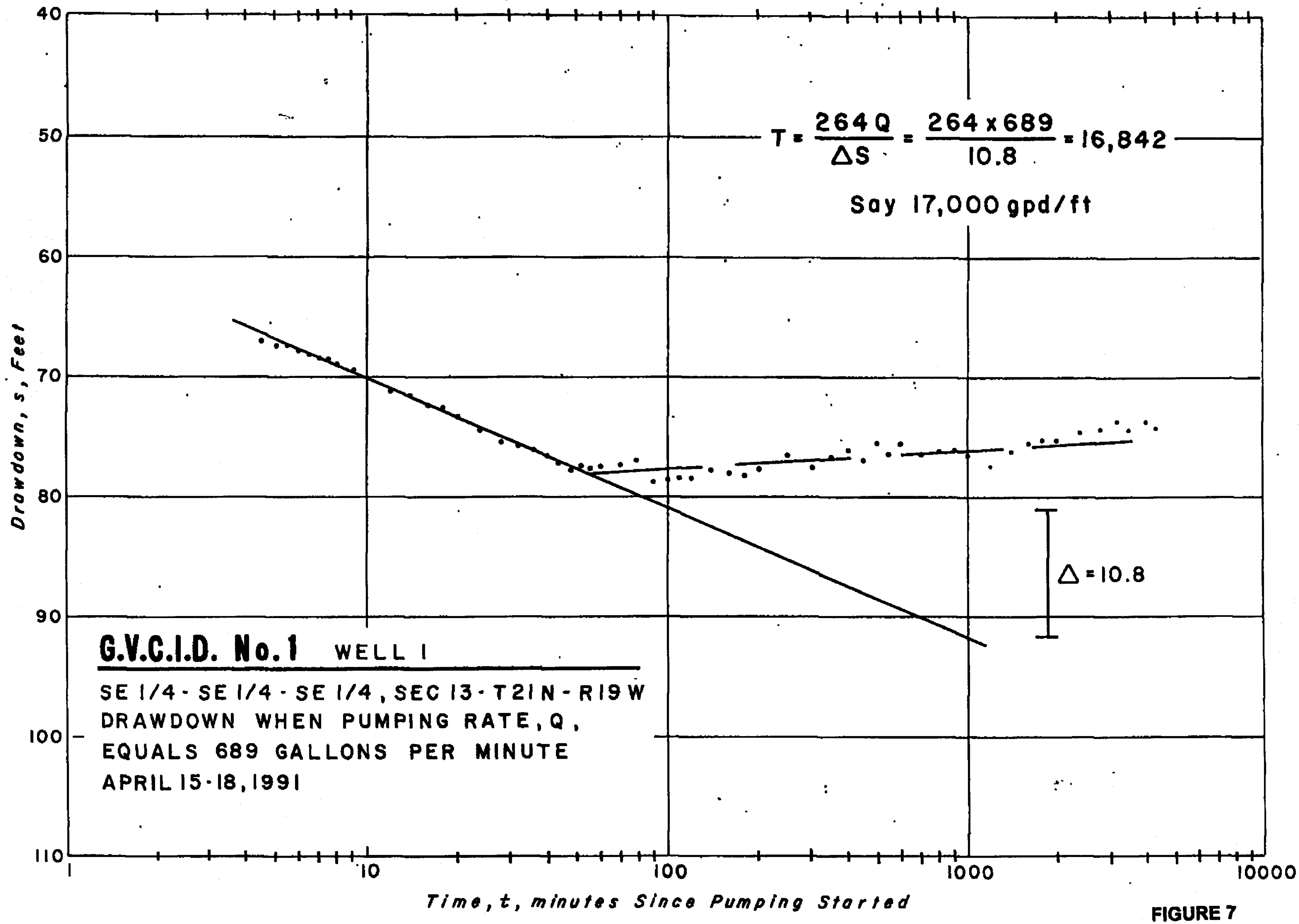
SHOWING MINIMUM THICKNESS OF SATURATED ALLUVIAL FILL

MINIMUM THICKNESS BECAUSE MANY WELL LOGS TERMINATE IN ALLUVIUM INDICATING GREATER THICKNESSES

443 Known Thickness
of saturated alluvial fill
in feet

Taken from ADWR
Open File Data

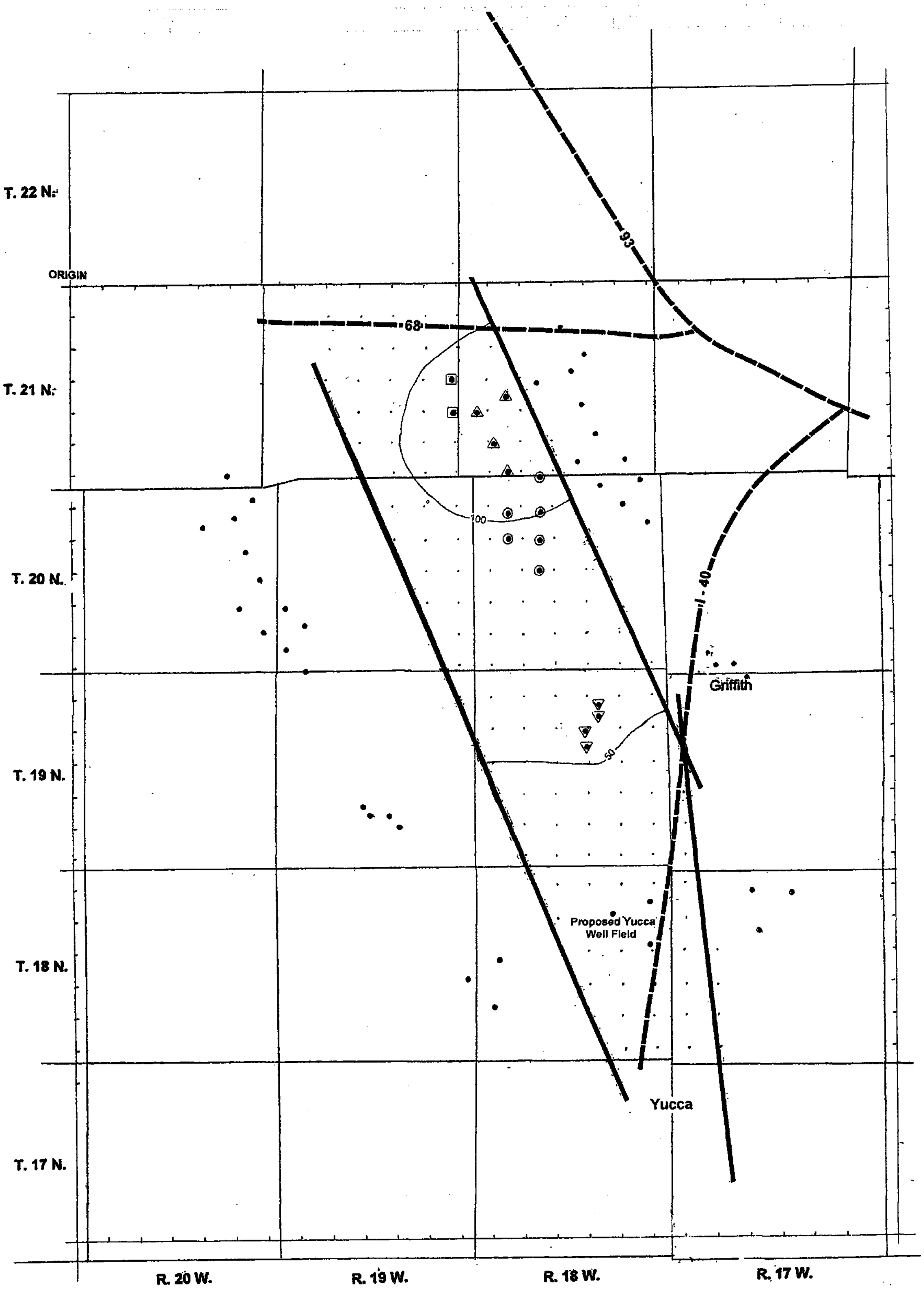
FIGURE 6



40
50
60
70
80
90
100
110
Drawdown, s, Feet
1
10
100
1000
10000
Time, t, minutes Since Pumping Started
T = 264Q / ΔS = 264 x 689 / 10.8 = 16,842
Say 17,000 gpd/ft
Δ = 10.8
G.V.C.I.D. No. 1 WELL 1
SE 1/4 - SE 1/4 - SE 1/4, SEC 13 - T21N - R19W
DRAWDOWN WHEN PUMPING RATE, Q,
EQUALS 689 GALLONS PER MINUTE
APRIL 15-18, 1991

FIGURE 7

PLATES 1 - 8



Legend

- G.V.I.D. Wells
- Valley Pioneer Water Company Wells
- Rhodes Golden Valley South Wells
- I - 40 Corridor Wells
- Yucca (theoretical) Wells
- Hydrologic (Model) Boundaries
- Highways

N

0 1 2 3 4
Scale, miles

GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

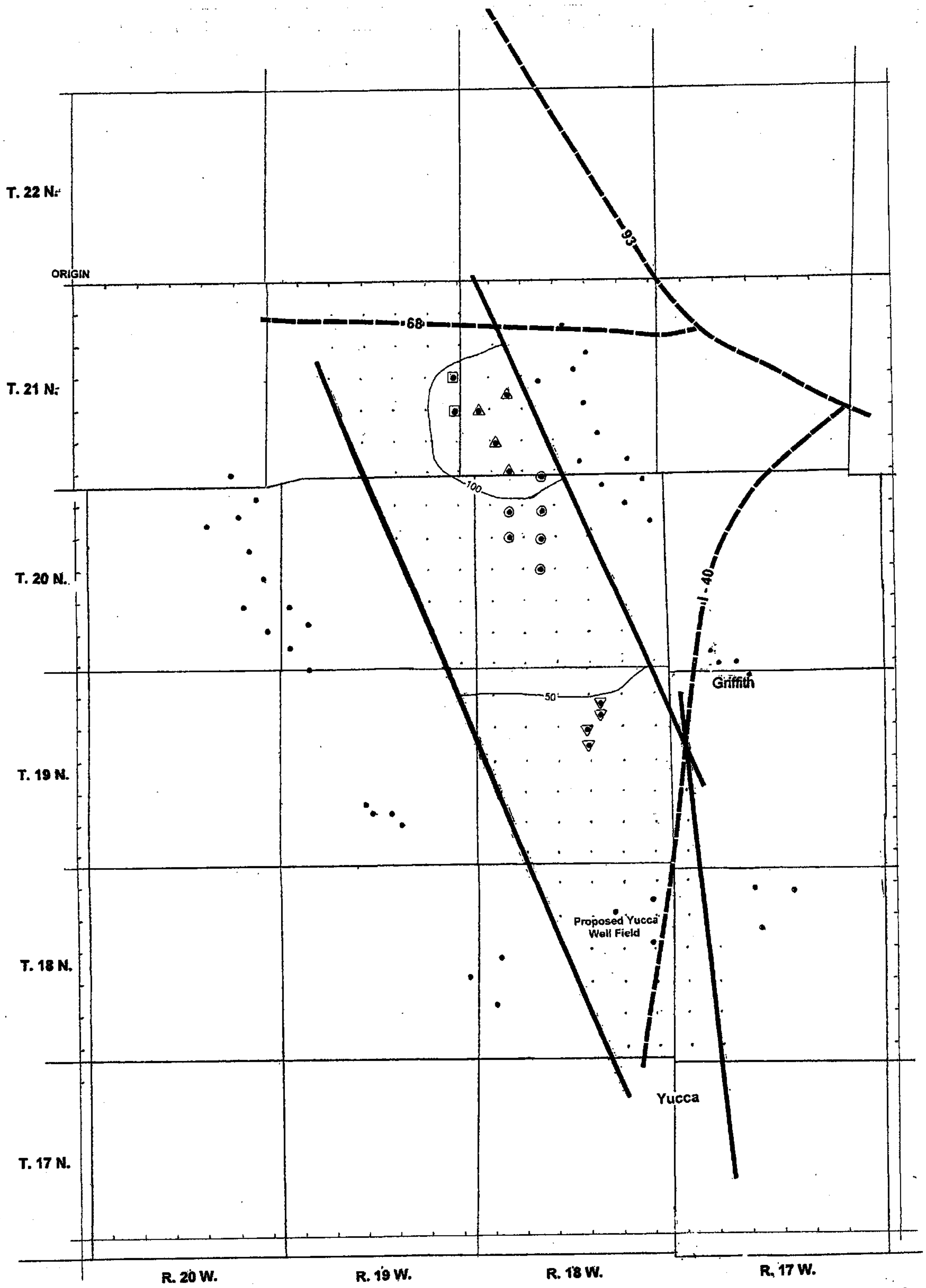
WHEN T = 46,000 gpd/ft and SY = .07

COMMITTED DEMAND:

GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

2007 - 2107

PLATE 1



Legend

- G.V.I.D. Wells
- Valley Pioneer Water Company Wells
- Rhodes Golden Valley South Wells
- I - 40 Corridor Wells
- Yucca (theoretical) Wells
- Hydrologic (Model) Boundaries
- Highways

GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

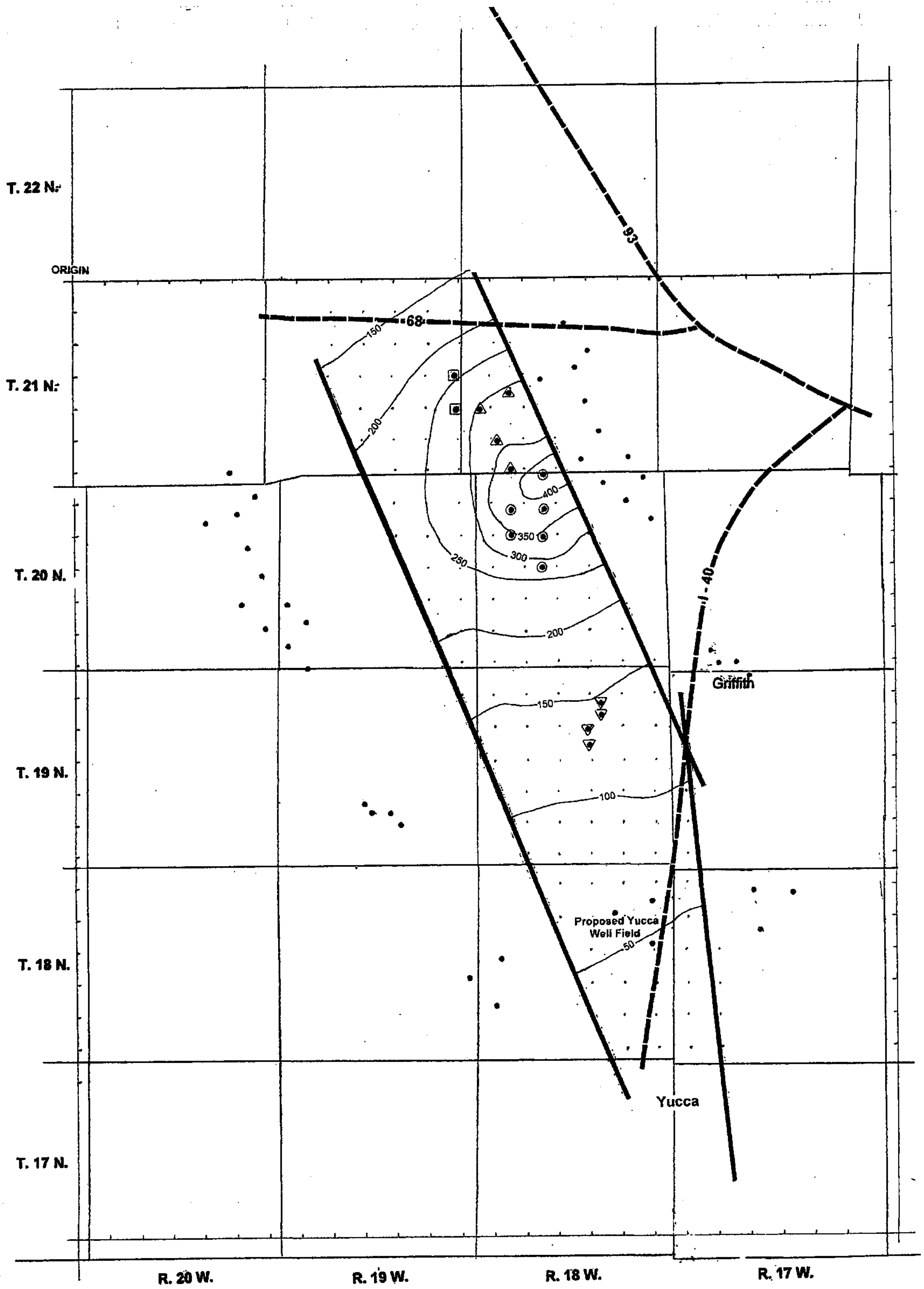
WHEN T = 46,000 gpd/ft and SY = .09

COMMITTED DEMAND:

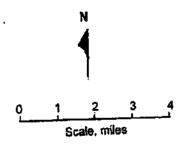
GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

2007 - 2107

PLATE 2



Legend
- G.V.I.D. Wells
- Valley Pioneer Water Company Wells
- Rhodes Golden Valley South Wells
- I - 40 Corridor Wells
- Yucca (theoretical) Wells
- Hydrologic (Model) Boundaries
- Highways



GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

WHEN T = 46,000 gpd/ft and SY = .07

COMMITTED DEMAND:

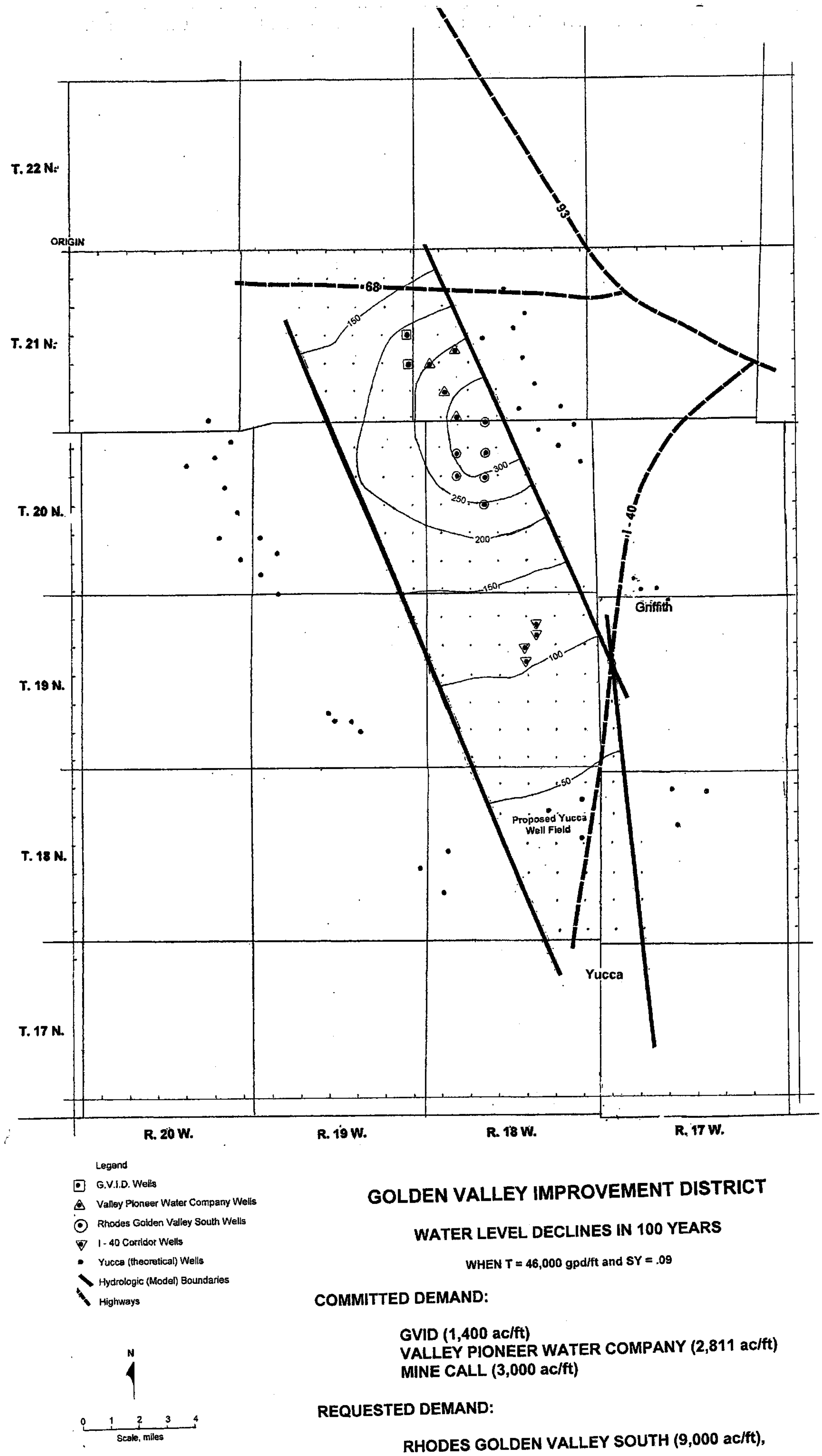
GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

REQUESTED DEMAND:

RHODES GOLDEN VALLEY SOUTH (9,000 ac/ft),

2007 - 2107

PLATE 3



GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

WHEN T = 46,000 gpd/ft and SY = .09

COMMITTED DEMAND:

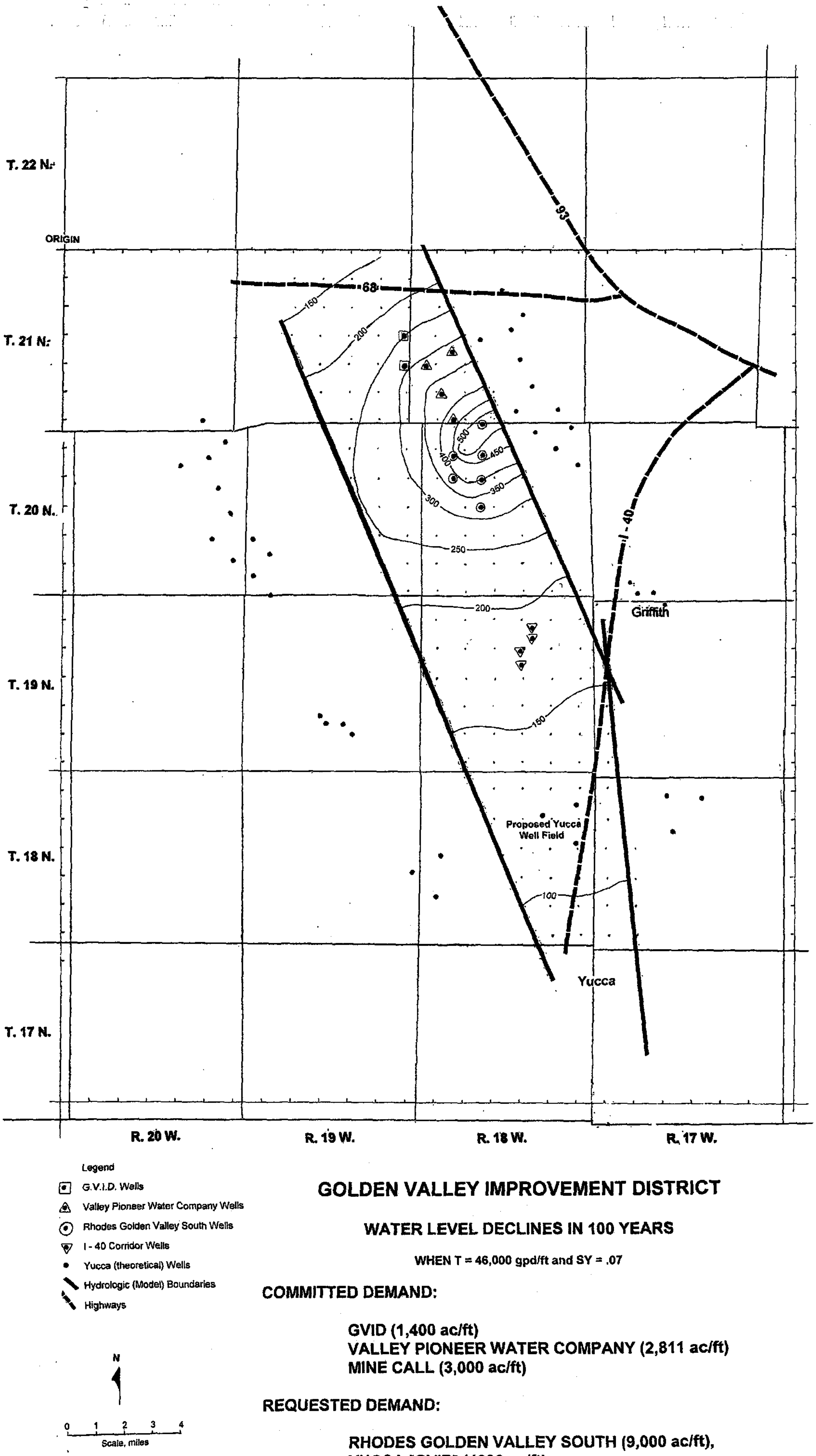
GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

REQUESTED DEMAND:

RHODES GOLDEN VALLEY SOUTH (9,000 ac/ft),

2007 - 2107

PLATE 4



GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

WHEN T = 46,000 gpd/ft and SY = .07

COMMITTED DEMAND:

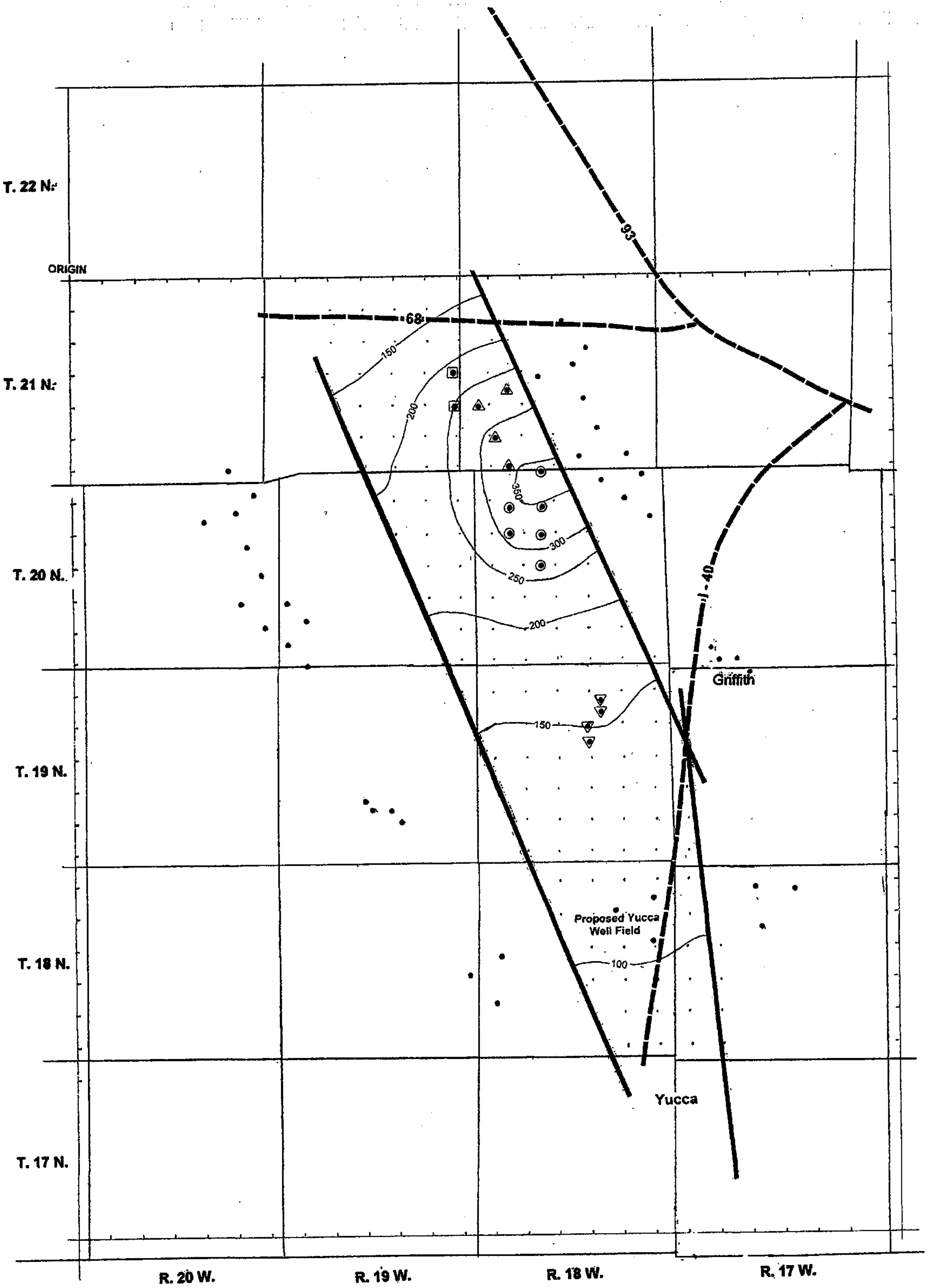
GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

REQUESTED DEMAND:

RHODES GOLDEN VALLEY SOUTH (9,000 ac/ft),
YUCCA [GVID] (4000 ac/ft)

2007 - 2107

PLATE 5



Legend
- G.V.I.D. Wells
- Valley Pioneer Water Company Wells
- Rhodes Golden Valley South Wells
- I - 40 Corridor Wells
- Yucca (theoretical) Wells
- Hydrologic (Model) Boundaries
- Highways

N

0 1 2 3 4
Scale, miles

GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

WHEN T = 46,000 gpd/ft and SY = .09

COMMITTED DEMAND:

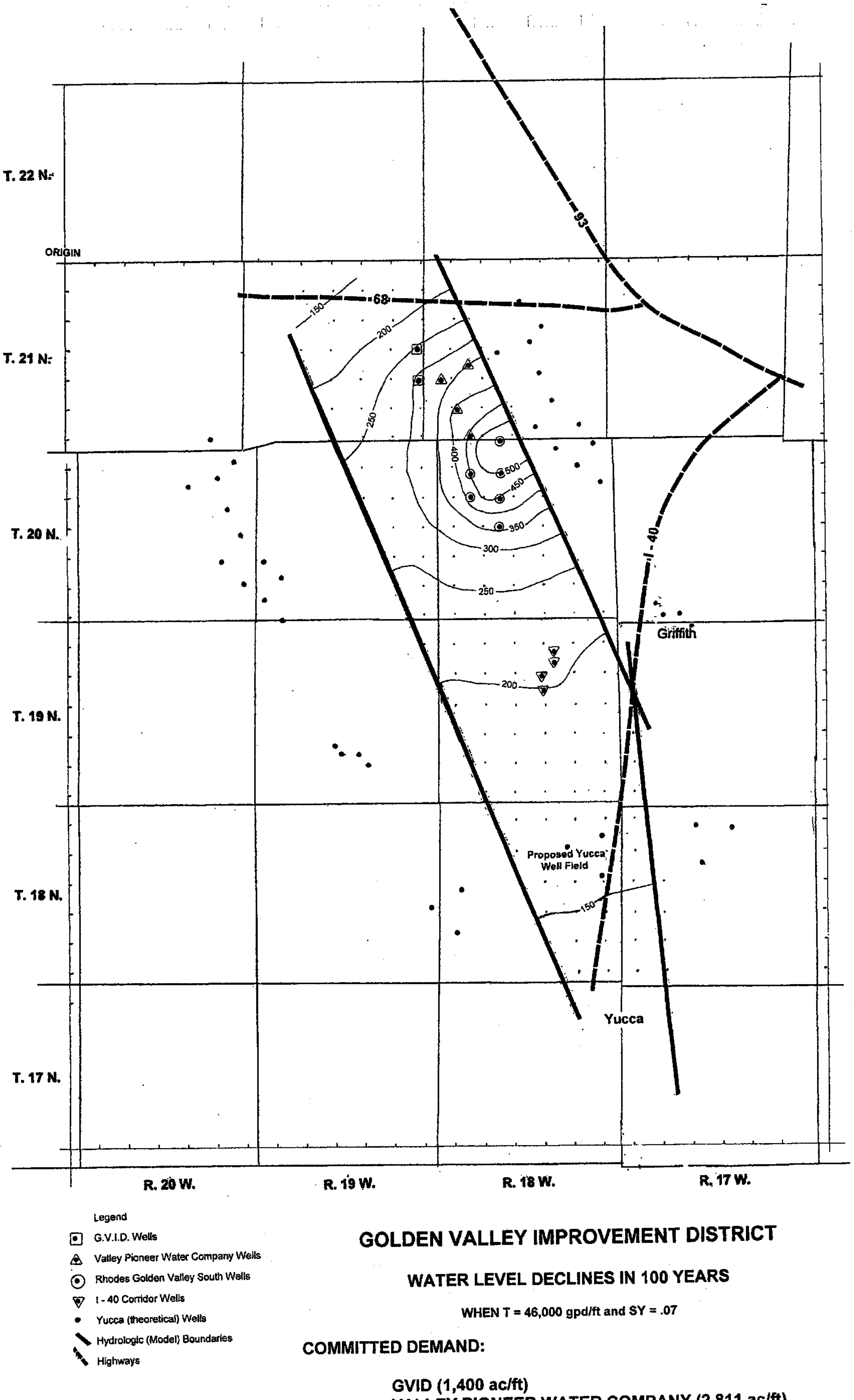
GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

REQUESTED DEMAND:

RHODES GOLDEN VALLEY SOUTH (9,000 ac/ft),
YUCCA [GVID] (4000 ac/ft)

2007 - 2107

PLATE 6



GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

WHEN T = 46,000 gpd/ft and SY = .07

COMMITTED DEMAND:

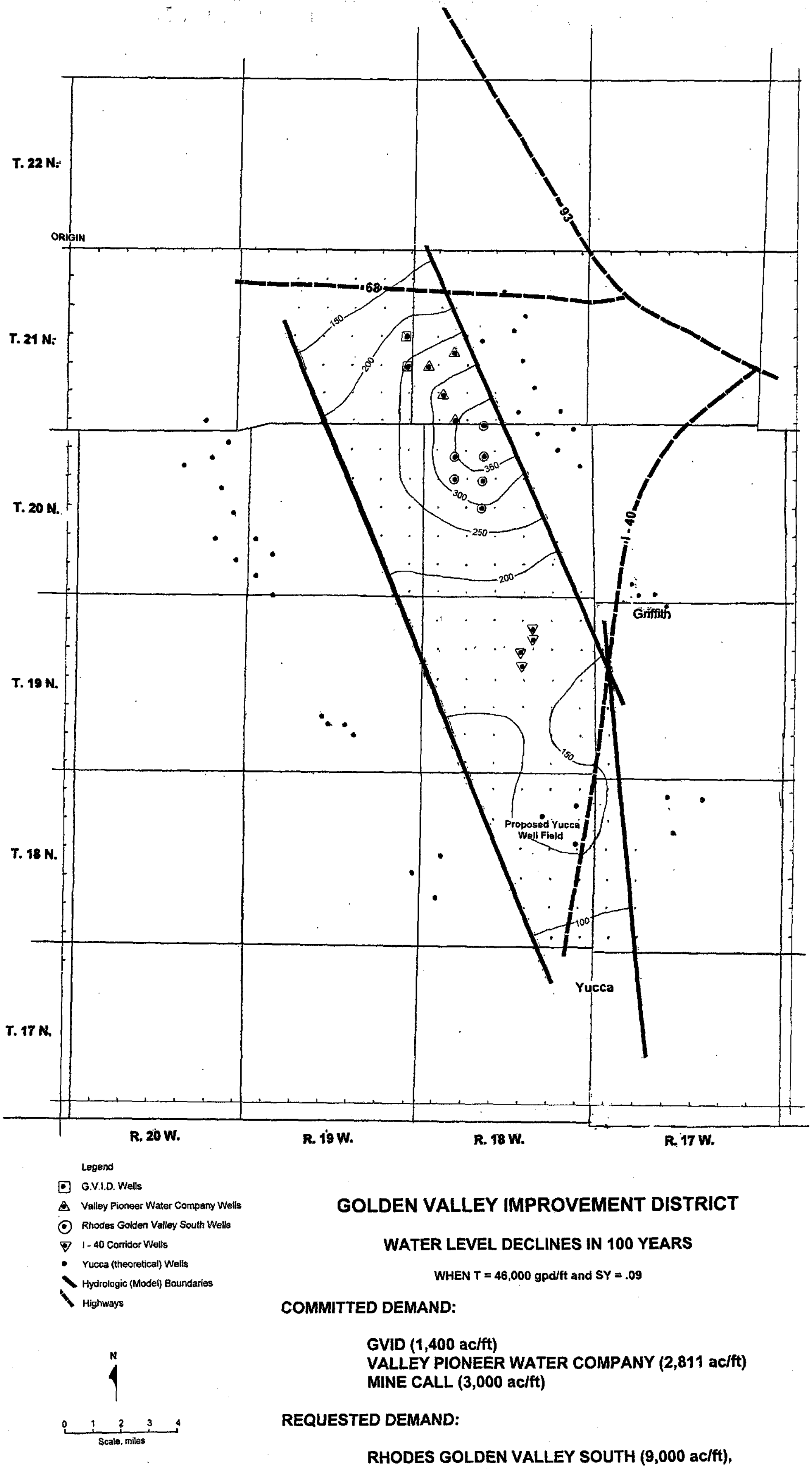
GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

REQUESTED DEMAND:

RHODES GOLDEN VALLEY SOUTH (9,000 ac/ft),
YUCCA [GVID] (6000 ac/ft)

2007 - 2107

PLATE 7



GOLDEN VALLEY IMPROVEMENT DISTRICT

WATER LEVEL DECLINES IN 100 YEARS

WHEN T = 46,000 gpd/ft and SY = .09

COMMITTED DEMAND:

GVID (1,400 ac/ft)
VALLEY PIONEER WATER COMPANY (2,811 ac/ft)
MINE CALL (3,000 ac/ft)

REQUESTED DEMAND:

RHODES GOLDEN VALLEY SOUTH (9,000 ac/ft),
YUCCA [GVID] (6000 ac/ft)

2007 - 2107

PLATE 8

2 million gallons per day for January, February and March.

The 35 year usage of 83,894 acre feet was then spread over the 100 year period of the simulated withdrawal yielding 839 ac/ft/yr.

The total I-40 Corridor well field then had a projected withdrawal of 1,239 acre feet per year.

The total volume of withdrawal was then apportioned to the number of wells operated in each entity.

Simulated Withdrawal from Basin

Withdrawal of ground water from the alluvial basin, used in the simulation model, was based on the complete build out as of January 1, 2007. The volume of withdrawal was the volume allocated by some form of an adequate water supply designation by the ADWR, plus the projected demand of the I-40 Industrial Corridor near Griffith and the 6,000 acre feet per year requested by virtue of this report and application.

The location of wells, ADWR I.D. Number and the committed volume of withdrawal, as of October 2006, from each well used in model are:

Present Designations or Demands:

Golden Valley Improvement District		1,400 ac/ft/yr
B(21-19)13ddd	55-530666	624,960 gpd
B(21-19)25aaa	55-530665	624,960 gpd
Valley Pioneer Water Company, including the Mine call		5,810 ac/ft/yr NO INFO.
B(21-18)20dbb	55-623084	1,296,631 gpd
B(21-18)30bba	55-623082	1,296,631 gpd
B(21-18)32bbb	55-623083	1,296,631 gpd
B(21-18)32dcc	55-623081	1,296,631 gpd
I-40 Industrial Corridor	(100 year basis)	1,239 ac/ft/yr
B(19-18)15acc	55-574436	276,527 gpd
B(19-18)10cdd	55-571367 571357	276,527 gpd
B(19-18)10aaa	55-580149	276,527 gpd
B(19-18)10daa	55-574434	276,527 gpd
Golden Valley 5800		9,000 ac/ft/yr
B(20-18)4aaa		1,339,114 gpd
B(20-18)8bbb		1,339,114 gpd
B(20-18)8ccc		1,339,114 gpd

July 2005
REPORT

REGIONAL HYDROGEOLOGY, SOURCE OF WATER SUPPLY, AND PROJECTED 100-YEAR DRAWDOWN IMPACTS IN THE VICINITY OF THE GOLDEN VALLEY SOUTH MASTER PLANNED COMMUNITY MOHAVE COUNTY, ARIZONA

Prepared for:

RHODES HOMES – ARIZONA LLC

[redacted]

23-401823.0000
GOLDEN VALLEY 5800

Prepared by:

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY

7949 EAST ACOMA DRIVE, SUITE 100
SCOTTSDALE, ARIZONA 85260 (480) 948-7747

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ERROL L. MONTGOMERY & ASSOCIATES, INC.

July 2005
REPORT

REGIONAL HYDROGEOLOGY, SOURCE OF WATER SUPPLY, AND PROJECTED 100-YEAR DRAWDOWN IMPACTS IN THE VICINITY OF THE GOLDEN VALLEY SOUTH MASTER PLANNED COMMUNITY MOHAVE COUNTY, ARIZONA

Prepared for:
RHODES HOMES – ARIZONA LLC

SUMMARY AND CONCLUSIONS

The following summary and conclusions are based on compilation and review of hydrogeologic data for the study area and development and testing of an analytical model. Projections of 100-year impacts from pumping to supply the proposed development at the Golden Valley South Master Planned Community (the "Property") indicate the availability of 15,000 acre-feet per year (AF/yr) of good quality groundwater, which exceeds the projected water demand for the proposed development.

1. The parcels comprising the proposed development at Golden Valley South are identified as the "Property", and are located in a northern part of Sacramento Valley known as Golden Valley. The Property includes approximately 5,800 acres south of State Highway 68, west of Interstate Highway 40, and north of U.S. Highway 66 **(Figure 1)**. The proposed development is shown on the preliminary plat in

Attachment 2 of the Application and includes presently undeveloped desert land located in parts of 9 sections of land south from Shinarump Road (Sections 2, 3, 4, 8, 9, 10, 11, 14, and 16, Township 20 North, Range 18 West), and a quarter section of land north from Shinarump Road (southwest quarter of Section 34, Township 21 North, Range 18 West). Title reports demonstrating property ownership are given in Attachment 4 of the Application.

2. The Sacramento basin is a graben developed between the major, gently east-dipping Mockingbird Mine fault on the west and the west-dipping Cerbat Mountains fault on the east. The basin is filled with a thick sequence of alluvial deposits of Tertiary to Quaternary age that overlies fractured granitic, metamorphic, and volcanic bedrock units, and is interbedded with younger volcanic rocks at some locations. The bedrock units form the basal and lateral boundaries of the basin and yield small quantities of groundwater to wells, except where abundantly fractured. The basin-fill alluvial deposits comprise the principal groundwater aquifer; thickness of these deposits ranges from a featheredge at the mountain fronts to possibly more than 4,000 feet in the north part of the basin. The volume of groundwater in storage in the principal Sacramento Valley aquifer system far exceeds the annual volume of recharge and discharge of groundwater in the basin.

3. The alluvial basin-fill deposits in Sacramento Valley have been divided into three major units: younger alluvium; intermediate alluvium; and older alluvium (Gillespie and Bentley, 1971). The older alluvium unit is the principal aquifer for virtually all of the existing production water wells in the non-bedrock areas of Sacramento

Valley. The lower part of the unit lies below groundwater table and reported yield to wells ranges from a few gallons per minute (gpm) to more than 2,000 gpm; most reported yields are small due chiefly to the pump capacity selected for domestic or stock use and are not representative for production capacity of the unit. At well GV-1 [B(21-18)34dba], located immediately north of the Property **(Figure 1)**, depth to non-pumping groundwater level in the older alluvium unit was about 765 feet below land surface (bls) and sustainable yield of the well exceeded the maximum capacity of the test pump, which was about 2,500 gpm. Well records and geophysical data for the basin demonstrate that the principal aquifer in Sacramento Valley is extensive, thick, and contiguous throughout most of the basin, and provides a good source of adequate groundwater supply to the proposed Rhodes Homes development. Data indicate that depth to bedrock and thickness of the older alluvium unit increase from east to west across the Property and are maximum near the west boundary of the Property.

4. Groundwater in the older alluvium unit in the north part of Sacramento Valley generally moves from north to south, as shown on **Figure 1**, in the same direction as ephemeral surface water flow in Sacramento Wash. Groundwater and surface water flow exits the basin to the Colorado River valley near Topock, Arizona; groundwater also leaves the basin by pumping from wells. Altitude of groundwater level in spring 1990 ranged from 1,800 feet above mean sea level (msl) north of State Highway 68 to 1,500 feet msl at Yucca (Rascona, 1991). Average hydraulic gradient of groundwater movement across the Property at that time was about 0.002, or 10.4 feet per mile. Altitude of groundwater level measured in the older

alluvium unit was about 1,794 feet msl in June 2005 at well GV-1. Results of drilling for well GV-1 suggest that unconfined aquifer conditions occur in the Property area.

5. The current average depth to groundwater at the Property is estimated to be about 755 feet bls. Therefore, it is assumed that the available groundwater level drawdown above the 1,200-foot Arizona Department of Water Resources (ADWR) water adequacy criterion is 445 feet.

6. Results of laboratory chemical analysis and measurements of field water quality parameters for depth-specific samples and a composite well head sample obtained from Rhodes Homes well GV-1 [B(21-18)34dba] are summarized in **Table 2**. Results indicate that, although elevated concentrations of arsenic were detected in the groundwater sample obtained in the depth interval from 1,160 to 1,180 feet bls during pilot borehole testing, chemical quality of the composite well head sample obtained from the completed well at the end of the 24-hour pumping test is excellent and meets all requirements for a new source of public water supply as defined by Arizona Department of Environmental Quality (ADEQ).

7. Records for 440 wells within the study area were compiled from the ADWR "55" well registry, "35" well registry, and Groundwater Site Inventory databases **(Table 1)**. Historic pumping from wells in the study area is poorly documented, except for the Griffith Energy power plant wells, public water supply wells for Valley Pioneer's Water Company and Golden Valley County Improvement District No. 1 (GVCID), and anecdotal information for past use of the Mineral Park

wells. Records are poor for pumping for other domestic, industrial, irrigation, stock, and other small capacity uses.

8. Based on the current groundwater withdrawals at the large production wells in the area versus past withdrawals, it was considered appropriate to add a simulated regional decline of 1 foot per year (ft/yr) to the projected drawdown impact for the model to represent future pumping from active wells in the area. This 1 ft/yr regional decline is designed to simulate both the ongoing current demand of the area and increased future pumpage for Pioneer's Valley Water Company for additional committed demand they will likely serve in the future. Many of the pre-platted lots in Golden Valley lie within the service area for Valley Pioneer's Water Company or GVCID.

9. According to the Golden Valley Area Plan (Mohave County, 2002), there are several areas of Golden Valley South that have pre-1965 platted subdivisions. The purpose and intent of the GVCID is to provide future water and road improvements to those subdivisions through their current designation of water adequacy. It is reasonable to assume that the current and committed demand within the area of Golden Valley 5800 parcel, owned by Rhodes Homes, is sufficiently simulated by a 1 ft/yr ongoing regional decline rate over 100 years.

10. Based on pumping test data for wells in the Property area, the geometric mean hydraulic conductivity for the principal aquifer is calculated to be about 100 gallons per day per square foot (gpd/ft^2). Based on data obtained for well GV-1 and on geophysical data for the Property area, average saturated thickness of the aquifer at the

Property area is estimated to be more than 750 feet. To provide a conservatively small estimate of saturated aquifer thickness for modeling purposes, a value of 550 feet was used. Based on this information, an average aquifer transmissivity of 55,000 gallons per day per foot width of aquifer (gpd/ft) was used to simulate impacts of pumping for the model.

11. Gillespie and Bentley (1971) estimated that specific yield of the principal aquifer in Sacramento Valley ranges from 0.05 to 0.10. Results of drilling for well GV-1 suggest that unconfined aquifer conditions occur in the Property area. Therefore, a specific yield of 0.07 was used to simulate impacts of proposed pumping at the Property for the model.

12. Projected water demands were estimated for the proposed development based on the projected number of residential units and acreages for other land uses identified by Rhodes Homes. Types of residential lots include only single family; residential water demands include interior and exterior uses. Other water demands include: interior and exterior demands for commercial property and schools, and landscaping demands for right-of-ways, easements, and parks. In addition, water demands for construction water and for lost and unaccounted for water were included. The projected total water demand following build out is estimated to be about 14,714 AF/yr.

13. Projections of 100-year drawdown resulting from estimated groundwater pumping for water supply at the Property were made using the computer software "THWELLS" (van der Heijde, 1996). Based on depth to bedrock contours, groundwater level contours,

regional gravity survey data, and records for wells in the basin, two hydrologic barrier boundaries were simulated to represent the basin bounding faults along the east and west margins of the basin floor **(Figures 1 and 5)**. In addition, although available data do not support the existence of a hydrologic barrier boundary between the Sacramento and Detrital Valleys, such a boundary was added to the model to address concerns voiced by ADWR staff at a preliminary project meeting held on June 7, 2005.

14. **Table D-1 and Figure 5** show the simulated drawdown caused solely by the proposed pumping at the property; the regional groundwater level decline of 1 ft/yr (100 feet over 100 years of pumping) must be added to the drawdown shown. Maximum simulated groundwater level drawdown from all sources of pumping, including the regional groundwater level decline, is about 399 feet at Pumping Well 5 **(Table D-1)**, which is the sum of the simulated drawdown due to pumping at the property (299 feet) plus 100 feet of regional groundwater level decline. Therefore, the resulting maximum depth to water after 100 years at Pumping Well 5 is projected to be about 1,154 feet bls, which is the average current depth to groundwater at the Property of 755 feet bls plus the simulated drawdown of 399 feet.

15. Projected 100-year impacts of pumping for water supply for the proposed development indicate that less than 300 feet of additional drawdown will be required to meet the needs of the development, and sufficient groundwater is available to serve the development and meet all ADWR requirements.

ERROL L. MONTGOMERY & ASSOCIATES, INC.

July 2005
REPORT

REGIONAL HYDROGEOLOGY, SOURCE OF WATER SUPPLY, AND PROJECTED 100-YEAR DRAWDOWN IMPACTS IN THE VICINITY OF THE GOLDEN VALLEY SOUTH MASTER PLANNED COMMUNITY MOHAVE COUNTY, ARIZONA

Prepared for:
RHODES HOMES – ARIZONA LLC

INTRODUCTION

On behalf of RHODES HOMES – ARIZONA LLC ("Rhodes Homes"), Errol L. Montgomery & Associates, Inc. (M&A) has prepared this report to document results of review and analysis of hydrogeologic information for the vicinity of the proposed development identified as the Golden Valley South Master Planned Community in Mohave County, Arizona. The proposed development is referred to as the Rhodes Golden Valley 5800 site in some previous documents. The purpose of this review and analysis is to evaluate the potential for development of a 100-year groundwater supply to serve the proposed Golden Valley South development. This report includes a summary of available hydrogeologic data, calculation of water demands for the development based on projected land-use information provided by Rhodes Homes, development of an analytical model for the study area, and use of the model to project impacts of groundwater pumping for the 100-year water supply for the proposed development. This report comprises Attachment 5 of the Application for Analysis of Water Adequacy being submitted to Arizona Department of Water Resources (ADWR).

DESCRIPTION OF STUDY AREA

The study area is located in the Mohave Desert, which is a transitional area separating the Great Basin Desert to the north and the Sonoran Desert to the south (Rascona, 1991). **Figure 1** is a location map for the study area. The parcels comprising the proposed Golden Valley South Master Planned Community are identified as the "Property", and are located in a northern part of Sacramento Valley known as Golden Valley. The Property includes approximately 5,800 acres (Stanley Consultants Inc., 2005) south of State Highway 68, west of Interstate Highway 40, and north of U.S. Highway 66 **(Figure 1)**. Title reports demonstrating property ownership are given in Attachment 4 of the Application.

The proposed development is shown on the preliminary plat in Attachment 2 of the Application and includes presently undeveloped desert land located in parts of 9 sections of land south from Shinarump Road (Sections 2, 3, 4, 8, 9, 10, 11, 14, and 16, Township 20 North, Range 18 West), and a quarter section of land north from Shinarump Road (southwest quarter of Section 34, Township 21 North, Range 18 West). This report describes water demands and impacts from development of the parcels currently owned by Rhodes Homes. Hydrogeologic conditions are summarized for the area shown on **Figure 1**, which is defined by the basin boundary on the north, east, and west, and by an arbitrary east-west boundary located south from Yucca, Arizona, approximately coinciding with the south boundary of Township 17 North. The study area comprises the entire northern part of Sacramento Valley.

HYDROGEOLOGIC CONDITIONS

Sacramento Valley has a semi-arid climate characterized by hot summers and mild winters; average annual precipitation ranges from about 7.6 inches at Yucca, in the south part of the study area, to about 10.5 inches at Kingman, northeast from the Property (Western Regional Climate Center, 2005). Streams in Sacramento Valley are generally ephemeral and flow only in direct response to storm water runoff events; therefore, groundwater is the only reliable source of water. The valley floor in the north part of Sacramento Valley consists of gently sloping, coalescing alluvial fans that extend from the mountain fronts on the west and east margins of the elongate basin and meet along the Sacramento Wash channel, which flows south through the basin and is tributary to the Colorado River. Sacramento Wash flows along the west boundary of the Property. The valley floor in the north part of Sacramento Valley slopes southward from an altitude of about 3,420 feet above mean sea level (msl) at the topographic divide with Detrital Valley about 1.5 miles southwest from Grasshopper Junction to about 1,700 feet msl near Yucca, Arizona. Maximum altitudes in the basin range from 5,216 feet msl near Mount Nutt in the Black Mountains on the west to 8,417 feet msl at Hualapai Peak in the Hualapai Mountains on the east. Groundwater and surface water flow exits the basin to the Colorado River valley near Topock, Arizona; altitude of land surface at Topock is about 460 feet msl. Groundwater also leaves the basin by pumping from wells.

A literature search was conducted to obtain published reports for the area that contain relevant hydrogeologic information. Sources of hydrogeologic information used for this study include publications and data files of the U.S. Geological Survey (USGS), ADWR, the Arizona Geological Survey, the Nevada Bureau of Mines and Geology, the Utah Geological Association, universities, and private consultants. In addition, production water well GV-1 (ADWR registration number 55-901789) was constructed and tested for Rhodes Homes one-half mile north of the Property at state cadastral location (B-21-18)34dba. Data obtained from these sources include: 1) well construction details; 2) reported well pumping rates; 3) groundwater level data; 4) groundwater quality data; 5) lithologic, physical, and structural characteristics for geologic units; and 6) aquifer parameters and pumping test data.

An inventory of well records for the study area shown on **Figure 1** is given in **Table 1**. To focus on the aquifers in the study area that are important to water supply for the Property, **Table 1 and Figure 1** exclude wells located in the bedrock areas shown on **Figure 1**. The well numbering system for the State of Arizona is described in **Appendix A**. A lithologic log for new production water well GV-1 is given in **Appendix B**.

PREVIOUS INVESTIGATIONS

Literature reviewed and used for preparation of this summary hydrogeologic report is listed in the References Cited section. Previous investigations by Richard and others (2000) document geology of the mountain ranges that bound the groundwater basin in which the Property lies. Data for the groundwater system and hydrogeologic conditions beneath the floor of Sacramento Valley are available from results of drilling and testing selected wells in the basin. For the Property area, lithologic logs and pumping test results are available for deep wells constructed for the Mineral Park mining operations (Gillespie and Bentley, 1971), Golden Valley County Improvement District (GVCID) No. 1 (Manera, Inc., 1991), Griffith Energy, L.L.C. (Manera, Inc., 1999), and Rhodes Homes (this report). Gillespie and others (1966), Gillespie and Bentley (1971), and Rascona (1991) provide groundwater basic data and analyses of the hydrogeologic system in the Property area.

A key aspect of the hydrogeologic conditions in Sacramento Valley is the complex structural geology of the region, which affects the geometry, boundaries, and lithology of the groundwater aquifers. Numerous studies have been published for the geologic evolution of the northern Colorado River extensional corridor in northwest Arizona and southern Nevada and the transition from the Colorado Plateau to the Basin and Range Physiographic Province. Faulds and others (2001) provide a particularly useful compilation and synthesis of the regional structural and geologic conditions that affect the Sacramento Valley groundwater system.

GEOLOGIC CONDITIONS

The Property is located in the north-central part of an elongate structural basin bounded on the east by the north-northwest-trending Cerbat Mountains and Hualapai Mountains, and on the west by the north-northwest-trending Black Mountains **(Figure 1)**. The Sacramento groundwater basin is further bounded on the north by a groundwater and surface water divide with Detrital Valley and on the south by the Mohave and McCracken Mountains. South of the study area, the northern and southern parts of Sacramento Valley coalesce and both surface water and groundwater exit the basin westward toward the Colorado River near Topock, Arizona. The entire basin is about 70 miles long from north to south and is an average of about 20 miles wide from east to west; total area of the basin is about 1,500 square miles (Rascona, 1991). The study area is underlain by Quaternary and Tertiary alluvial sediments that were deposited in the structural basin, which encompasses the main part of Sacramento Valley. Extent of the alluvial basin is generally defined by fault-block mountain ranges, characteristic of the Basin-and-Range physiographic province.

The mountain ranges are composed chiefly of uplifted Precambrian metamorphic and igneous rocks that have been intruded by younger igneous rocks. The Cerbat Mountains to the northeast and the Hualapai Mountains to the east are composed primarily of Precambrian granitic igneous rocks and gneiss with some schist (Gillespie and Bentley, 1971). The Black Mountains to the west are composed primarily of Tertiary, and Cretaceous (?) and Tertiary volcanic rocks with some Precambrian metamorphic rocks (Gillespie and Bentley, 1971). The older volcanic rocks consist of a thick sequence of andesite and latite flows and tuff beds, and form the main mass of the Black Mountains (Gillespie and Bentley, 1971). The younger volcanic rocks consist of basalt flows, basaltic andesite flows and tuff, and rhyolite tuff and ignimbrites; these rocks crop out over large areas near Kingman, where they are the principal aquifer for the Kingman well field, and in the Black Mountains (Gillespie and Bentley, 1971). The younger volcanic rocks are interbedded with the older alluvium in the basin-fill deposits. The mountain ranges and alluvial basin are associated with a complex structural history of extensional faulting that occurred chiefly between 15 and 6 million years ago (Anderson and others, 1992).

The Sacramento Valley groundwater basin is filled with a thick sequence of alluvial deposits of Tertiary to Quaternary age that overlies fractured granitic, metamorphic, and volcanic bedrock units, and is interbedded with younger volcanic rocks at some locations. The bedrock units form the basal and lateral boundaries of the basin and yield small quantities of groundwater to wells, except where abundantly fractured. The basin-fill alluvial deposits comprise the principal groundwater aquifer; thickness of these deposits ranges from a featheredge at the mountain fronts to possibly more than 4,000 feet in the north part of the basin (Gillespie and Bentley, 1971). Depth to bedrock contours, as defined by Oppenheimer and Sumner (1980), are shown on **Figure 1** for the north part of the basin. The alluvial basin-fill deposits in Sacramento Valley have been divided into three major units: younger alluvium; intermediate alluvium; and older alluvium (Gillespie and Bentley, 1971).

Younger Alluvium

The younger alluvium of Holocene age consists of unconsolidated gravel, sand, silt, and clay deposited on alluvial slopes and flood plains and in stream channels (Wilson and Owen-Joyce, 1994). The deposits chiefly contain fragments of granite, schist, gneiss, and volcanic rocks and range in thickness from a few feet to as much as 50 feet (Gillespie and Bentley, 1971). Where penetrated by well GV-1 near the Property **(Figure 1)**, the lithologic log suggests that younger alluvium may have been penetrated from land surface to a depth of 40 feet below land surface (bls) based on grain size distribution **(Appendix B)**. This unit is important for conveying recharge of storm water runoff to deeper units along stream channels, but generally is not important as a source of groundwater for wells in Sacramento Valley, except where it may be saturated in mountain stream channels.

Intermediate Alluvium

The intermediate alluvium may be of Pleistocene and Tertiary age and is an extensive near-surface deposit underlying the valley floor (Gillespie and Bentley, 1971). The deposits chiefly contain weakly to moderately consolidated fragments of granite, schist, gneiss, and volcanic rocks and range in thickness from 200 to 500 feet (Gillespie and Bentley, 1971). Where penetrated by well GV-1 near the Property **(Figure 1)**, the lithologic log suggests that the intermediate alluvium may have been penetrated from 40 to 400 feet bls based on grain size distribution and lithification **(Appendix B)**. This unit is important for conveying recharge of storm water runoff to deeper units along stream channels and mountain fronts, but occurs chiefly above the groundwater table and, therefore, is generally not important as a source of groundwater for wells in Sacramento Valley.

Older Alluvium

The older alluvium of Tertiary age was deposited in alluvial fans that extend from the surrounding mountain ranges into the valley floor and consists of weakly to moderately consolidated gravel, sand, silt, and clay (Wilson and Owen-Joyce, 1994). The mineralogy and rock type of the older alluvium sands and gravels are representative of the source rocks in the surrounding mountains that have shed into the basin by erosive processes. Where penetrated by well GV-1 near the Property, this unit consists chiefly of gravel, sand, and clay interbedded with lava flow rock and some tuff **(Appendix B)**.

Granitic bedrock was encountered in well GV-1 at a depth of 1,550 feet bls; therefore, if the upper contact of the unit is at 400 feet bls, thickness of the unit is 1,150 feet at well GV-1. Geophysical data indicate that depth to bedrock and thickness of the unit increases from east to west across the Property (Gillespie and Bentley, 1971; Oppenheimer and Sumner, 1980). Depth to bedrock at well GV-1 (1,550 feet bls) is about one-half the depth projected by Oppenheimer and Sumner (1980) (nearly 3,200 feet bls) **(Figure 1)**; however, data for other deep wells, such as the Christmas Tree wells by Santa Claus [well (B-22-18)4bbb with total depth of 2,510 feet bls and well (B-22-18)5dac with total depth of 2,437 feet bls **(Table 1)**] are consistent with the depth to bedrock contours of Oppenheimer and Sumner (1980).

A seismic refraction survey was conducted under USGS direction to measure thickness of the basin-fill alluvium along an east-west profile at the south boundary of the Property (Gillespie and Bentley, 1971). The USGS interpreted results of this survey to indicate that depth to bedrock increases from the east and west margins of the basin floor to a maximum depth of 4,400 feet bls about 1 mile due south of the westernmost boundary of the Property at the southwest corner of Section 8, Township 20 North, Range 18 West (Gillespie and Bentley, 1971). Depth to bedrock interpreted by USGS where well GV-1 is projected south orthogonally to the seismic profile is about 1,650 feet bls, which correlates well with the depth to bedrock at well GV-1 (1,550 feet bls). These relations indicate that depth to bedrock and thickness of the older alluvium unit increase from east to west across the Property and are maximum near the west boundary of the Property, as shown on **Figure 1**.

The older alluvium unit is the principal aquifer for virtually all of the existing production water wells in the non-bedrock areas of Sacramento Valley. The lower part of the unit lies below groundwater table and reported yield to wells ranges from a few gallons per minute (gpm) to more than 2,000 gpm **(Table 1)**; most reported yields are small due chiefly to the pump capacity selected for domestic or stock use and are not representative for production capacity of the unit. At well GV-1, located immediately north from the Property **(Figure 1)**, depth to non-pumping groundwater level in the older alluvium unit was about 765 feet bls and sustainable yield of the well exceeded the maximum capacity of the test pump, which was about 2,500 gpm.

GEOLOGIC STRUCTURAL FEATURES

Sacramento Valley lies in the northern Colorado River extensional corridor and the transition area from the Colorado Plateau to the Basin and Range

Physiographic Province. Extreme Cenozoic structural extension occurred in this region and was accompanied by extensive systems of high and low angle normal faults, listric normal faults, thrust faults, detachment faults, and strike-slip faults. The structural features of Sacramento Valley are classified in the Whipple domain, which comprises a system of east-dipping normal faults and west-tilted fault blocks (Faulds and others, 2001). This structural system is believed to be associated with abundant fracturing of bedrock and overlying lithified rock units.

The Sacramento basin is a graben developed between the major, gently east-dipping Mockingbird Mine fault on the west and the west-dipping Cerbat Mountains fault on the east (Faulds and others, 2001). These faults are associated with the model boundaries described later in this report.

Inspection of residual Bouguer anomaly gravity data for Sacramento Valley indicates that the low-gravity structural trough that is the basin graben extends north and south from the Rhodes Homes Property. These data, together with other well data and geophysical data for the basin, demonstrate that the principal aquifer in Sacramento Valley is extensive, thick, and contiguous throughout most of the basin, and provides a good source of adequate groundwater supply to the proposed Rhodes Homes development.

ADWR has raised the concern that an aquifer boundary may occur at the surface water divide between Sacramento and Detrital Valleys. The deep wells nearest to that area are the Christmas Tree wells near the town of Santa Claus **(Table 1; Figure 1)**, and include: Christmas Tree well no. 2 [(B-23-18)33cbc2], with a total depth of 2,132 feet bls and depth to water of 1,236 feet bls; Christmas Tree well no. 3 [(B-22-18)4bbb], with a total depth of 2,510 feet bls and depth to water of 1,207 feet bls; and Christmas Tree well no. 4 [(B-22-18)5dac], with a total depth of 2,437 feet bls and depth to water of 1,194 feet bls. The logs for these wells indicate that bedrock was not encountered; these wells are within 4 miles of the surface water divide **(Figure 1)**. These data indicate there is a substantial saturated thickness of the principal aquifer near the divide and, in the absence of any recognized major fault crossing the basin between the wells and the divide, suggest that an aquifer boundary does not occur between the two basins.

AQUIFER HYDRAULIC PROPERTIES

Important aquifer hydraulic properties that control rate of groundwater movement and amount of groundwater storage in the aquifer include transmissivity, hydraulic conductivity, and specific yield or storage coefficient. Transmissivity is defined as the rate of groundwater movement under a 1:1 hydraulic gradient through a vertical section of an aquifer 1 foot wide and extending the full saturated thickness of the aquifer (Theis, 1935). Units for transmissivity are gallons per day per foot width of aquifer (gpd/ft). Transmissivity is a measure of the ability of an aquifer to transmit groundwater and is equal to the product of hydraulic conductivity and saturated thickness of the aquifer. Hydraulic conductivity is defined as the rate of groundwater movement, under a 1:1 hydraulic gradient, through a unit area of aquifer material (Heath, 1989). Hydraulic conductivity has units of gallons per day per square foot (gpd/ft^2). Hydraulic conductivity is also commonly expressed in units of feet per day (ft/day), which is gpd/ft^2 divided by 7.48 gallons per cubic foot. Specific yield is defined as the volume of water that would drain from a unit volume of aquifer material and is dimensionless; this term is applied to unconfined aquifers. Storage coefficient is defined as the volume of water released from storage in a unit prism of an aquifer when the hydraulic head is lowered a unit distance; this term is applied to confined aquifers (Heath, 1989).

A search of ADWR records, USGS publications, and consultants reports yielded little pumping test information for wells in the Sacramento Valley groundwater basin. However, the available data are for wells located at or near the Rhodes Homes Property. Construction details for wells in the ADWR well records for Sacramento are summarized in **Table 1**. In addition, a pumping test was conducted by M&A for the principal aquifer at new production water well GV-1, located immediately north from the Property **(Figure 1)**.

Well GV-1 Pumping Tests

From June 2 to June 12, 2005, a step-rate pumping test and a constant-rate aquifer test were conducted at well GV-1. During the tests, the following parameters were monitored: depth to water level; instantaneous discharge rate; total volume of groundwater pumped; discharge pressure; and water quality parameters. Discharge rate was monitored using a mechanical flow meter and an orifice plate and manometer. Depth to groundwater level in the pumped well was monitored using both an electronic transducer connected to a datalogger and an electric water level sounder. Depth to groundwater level monitored using the transducer was calibrated using an electrical sounder before and after testing operations. Drawdown measured using the transducers was generally the same as drawdown measured using the sounder. Transmissivity was calculated from aquifer test results using the Cooper-Jacob graphical method (Cooper and Jacob, 1946).

On June 2 and 9, 2005, a step-rate pumping test was conducted at well GV-1 to select a sustainable pumping rate for the subsequent 24-hour constant-rate aquifer test and to evaluate well efficiency. During the step-rate test, the well was pumped for five periods (steps) of 120 minutes. During each step, a constant discharge rate was maintained. However, near the end of the third step conducted on June 2, pumping was stopped at the request of Mohave County until a culvert could be installed where the discharge water crossed Shinarump Road. The step test was resumed on June 9 after the culvert was installed and the third step was repeated. Discharge rate was increased for each subsequent step. At the end of the step-rate test, the pump was shut off and groundwater level was allowed to recover before conducting the aquifer test.

On June 10, 2005, a constant-rate aquifer test was conducted at well GV-1. Duration of the pumping period was 24 hours. A nearly constant discharge rate of about 2,020 gpm was maintained for the entire pumping period. All measurements for discharge rate were within 2 percent of the average pumping rate of 2,020 gpm. The pumping period was followed by a 24-hour recovery period. Results of the aquifer test are shown in **Figures 3 and 4**.

Pre-pumping depth to groundwater level was about 765 feet bls. Initial groundwater level drawdown was very rapid due to removal of water from wellbore storage. Subsequently, depth to groundwater level changed very slowly. Maximum drawdown after 24 hours of pumping was about 112 feet. Specific capacity was 18 gpm/ft after 24 hours of pumping.

Transmissivity calculated using the aquifer test data ranged from 200,000 gpd/ft for the pumping period to 700,000 gpd/ft for the recovery period. The transmissivity calculated for the recovery period is not affected by well efficiency or borehole "skin effects" due to non-laminar flow near the wellbore and, therefore, is considered to be more representative for the principal aquifer at the GV-1 location. However, to provide conservative modeling results for impact of pumping at the Property, the transmissivity calculated for the pumping period was used for estimating an average transmissivity for the basin.

Parameters Used for Model

Available data for aquifer hydraulic parameters reported for pumping tests conducted for the principal aquifer in the north part of Sacramento Valley are summarized as follows:

WELL IDENTIFIER	WELL NAME	TEST DATE	TRANSMISSIVITY (gpd/ft)	AVERAGE HYDRAULIC CONDUCTIVITY (gpd/ft²)	REFERENCE
B(20-18)4 bbb	MP-5	Pre-1971	46,000	70	Gillespie and Bentley (1971)
B(21-18)32 dcc	MP-1	Pre-1971	35,000	70	Gillespie and Bentley (1971)
(B-21-18) 34dba	GV-1	2005	200,000	435	Montgomery & Associates
(B-19-18) 10cdd	#1	1999	76,000	115	Manera, Inc. (1999)
(B-21-19) 13ddd	GVCID-1 #1	1991	17,000	42	Manera, Inc. (1991)
(B-21-19) 25aaa	GVCID-1 #2	1991	37,000	106	Manera, Inc. (1991)

Based on these data, the geometric mean hydraulic conductivity is about 100 gpd/ft^2. Based on data obtained for well GV-1 and on geophysical data for the Property area, average saturated thickness of the aquifer at the Property area is estimated to be more than 750 feet. To provide a conservatively small estimate of saturated aquifer thickness for modeling purposes, a value of 550 feet was used. Based on this information, an average aquifer transmissivity of 55,000 gpd/ft was used to simulate impacts of pumping for the model.

Gillespie and Bentley (1971) estimated that specific yield of the principal aquifer in Sacramento Valley ranges from 0.05 to 0.10. Results of drilling for well GV-1 suggest that unconfined aquifer conditions occur in the Property area.

Therefore, a specific yield of 0.07 was used to simulate impacts of proposed pumping at the Property for the model.

OCCURRENCE AND MOVEMENT OF GROUNDWATER

Groundwater in the older alluvium unit in the north part of Sacramento Valley generally moves from north to south, as shown on **Figure 1**, in the same direction as ephemeral surface water flow in Sacramento Wash (Rascona, 1991). Altitude of groundwater level in spring 1990 ranged from 1,800 feet msl north of State Highway 68 to 1,500 feet msl at Yucca (Rascona, 1991). Average hydraulic gradient of groundwater movement across the Property at that time was about 0.002, or 10.4 feet per mile. Altitude of groundwater level measured in the older alluvium unit was about 1,794 feet msl in June 2005 at well GV-1 [(B-21-18)34dba], located immediately north of the Property **(Table 1)**.

The volume of groundwater in storage in the principal Sacramento Valley aquifer system far exceeds the annual volume of recharge and discharge of groundwater in the basin. Estimates for groundwater in storage and for recharge to the aquifer have been reported by several authors and range widely. These topics are not addressed herein because it is assumed that no recharge occurs for projections of drawdown impact from proposed pumping at the Rhodes Homes Property. This assumption is commonly made for water adequacy studies to provide conservatively large projections of impact.

DEPTH TO GROUNDWATER LEVEL

In November 1995, depth to groundwater in the principal aquifer in Sacramento Valley ranged from about 300 feet bls at Yucca [(B-17-18)12bca] in the south part of the basin to about 1,235 feet bls near Santa Claus [(B-23-18)33cbc2] in the north part of the basin **(Table 1)**.

Depth to groundwater in the principal aquifer in June 2005 at well GV-1 [(B-21-18)34dba], located immediately north of the Property, was 765 feet bls **(Table 1)**. Depth to groundwater in August 2004 at well (B-20-18)22aac, located immediately south of the Property, was about 744 feet bls. The current average depth to groundwater at the Property is estimated to be about 755 feet bls. Therefore, it is assumed that the available groundwater level drawdown above the 1,200-foot ADWR water adequacy criterion is 445 feet.

EXISTING WELLS AND CURRENT GROUNDWATER PUMPING

Records for 440 wells within the study area were compiled from the ADWR "55" well registry, "35" well registry, and Groundwater Site Inventory databases, and are summarized in **Table 1**. Wells within the study area are shown on **Figure 1**.

Reported pumping rates for wells in the Property area range from a few gpm to more than 2,000 gpm **(Table 1)**. Historic pumping from wells in the study area is poorly documented, except for the Griffith Energy power plant wells, public water supply wells for Valley Pioneer's Water Company and Golden Valley County Improvement District No. 1 (GVCID), and anecdotal information for past use of the

Mineral Park wells. Records are poor for pumping for other domestic, industrial, irrigation, stock, and other small capacity uses.

CHANGE IN GROUNDWATER LEVELS

A hydrograph of groundwater level altitude for selected wells across the north part of Sacramento Valley is shown on **Figure 2**. Groundwater levels during the last 40 years have not changed substantially for wells near or at the Property. Prior to 1990, groundwater pumped from the Duval/Cypress production wells to supply the Mineral Park Mine operations comprised the majority of groundwater withdrawals from the basin. After 1990, these wells were transferred to Valley Pioneer's Water Company and are presently used at a fraction of the rate used for the mine.

Three wells shown on **Figure 2** that are pertinent for evaluating rate of groundwater level change at the Property are:

1. well (B-20-18)22aac, located immediately south of the Property **(Figure 1)**;
2. Mineral Park Well No. 5 [(B-20-18)4bbb], located in the north part of the Property; and
3. Mineral Park Well No. 2 [(B-21-18)30abb], located about 3 miles northwest of the Property.

From 1965 to 1990, average rate of groundwater level ***decline*** was 0.29 feet per year (ft/yr) at well (B-20-18)22aac, 0.51 ft/yr at well (B-20-18)4bbb, and 1.15 ft/yr at well (B-21-18)30abb. From 1990 to 1995, average rate of groundwater level ***rise*** was 0.06 feet per year (ft/yr) at well (B-20-18)22aac, 0.20 ft/yr at well (B-20-18)4bbb, and 3.16 ft/yr at well (B-21-18)30abb.

Based on the current groundwater withdrawals at the large production wells in the area versus past withdrawals, it was considered appropriate to add a simulated regional decline of 1 ft/yr to the projected drawdown impact for the model to represent future pumping from active wells in the area. This 1 ft/yr regional decline is designed to simulate both the ongoing current demand of the area and increased future pumpage for Pioneer's Valley Water Company for additional committed demand they will likely serve in the future. Many of the pre-platted lots in Golden Valley lie within the service area for Valley Pioneer's Water Company or GVCID.

COMMITTED DEMAND

According to the Golden Valley Area Plan (Mohave County, 2002), there are several areas of Golden Valley South that have pre-1965 platted subdivisions. The purpose and intent of the GVCID is to provide future water and road improvements to those subdivisions through their current designation of water adequacy. It is reasonable to assume that the current and committed demand within the area of Golden Valley 5800 parcel, owned by Rhodes Homes, is sufficiently simulated by a 1 ft/yr ongoing regional decline rate over 100 years.

GROUNDWATER QUALITY

Data obtained from the Arizona Department of Environmental Quality (ADEQ) 1999 baseline study of ambient groundwater quality in the Sacramento Valley basin (ADEQ, 2001) are summarized in **Appendix C**. Results indicate that groundwater quality in the central parts of the basin generally meets U.S. Environmental Protection Agency (EPA) primary maximum contaminant levels (MCLs) for drinking water (EPA, 2002). Groundwater samples from selected wells at the margins of the basin have been found to contain elevated concentrations of nitrate, gross alpha, fluoride, and/or total dissolved solids.

Results of laboratory chemical analysis and measurements of field water quality parameters for depth-specific samples and a composite well head sample obtained from Rhodes Homes well GV-1 [B(21-18)34dba] are summarized in **Table 2**. Results indicate that, although elevated concentrations of arsenic were detected in the groundwater sample obtained in the depth interval from 1,160 to 1,180 feet bls during pilot borehole testing, chemical quality of the composite well head sample obtained from the completed well at the end of the 24-hour pumping test is excellent and meets all requirements for a new source of public water supply as defined by ADEQ.

A search of Internet on-line data files for locations of WQARF and Superfund sites designated by ADEQ did not indicate the presence of contaminant sites in the study area.

COLORADO RIVER ACCOUNTING SURFACE

Wilson and Owen-Joyce (1994, p. v) define the "accounting surface" that is administered by the U.S. Bureau of Reclamation for the Colorado River corridor as follows:

> "The accounting surface represents the elevation and slope of the unconfined static water table in the river aquifer outside the flood plain and the reservoirs of the Colorado River that would exist if the river were the only source of water to the river aquifer. The accounting surface was generated by using profiles of the Colorado River and water-surface elevations of reservoirs, lakes, marshes, and drainage ditches."

Further, Wilson and Owen-Joyce (1994, p. 6) establishes the following criteria to determine if wells impact the Colorado River subflow:

> **Wells that impact the river subflow:** "Wells that have a static water-level elevation equal to or below the accounting surface are presumed to yield water that will be replaced by water from the river."
>
> **Wells that do not impact the river subflow:** "Wells that have a static water-level elevation above the accounting surface are presumed to yield water that will be replaced by water from precipitation and inflow from tributary valleys."

There are several factors that ensure production wells for the proposed Rhodes Homes development will not impact the river subflow by these criteria. The Property lies outside the accounting surface for Sacramento Valley. In addition, altitude of the groundwater table in the older alluvium unit measured in wells **(Table 1)** at or near the Property are more than 1,200 feet above the accounting surface, as demonstrated below:

CADASTRAL LOCATION	WELL NAME	WELL DEPTH (feet, bls)	LAND SURFACE ALTITUDE (feet, msl)	GROUNDWATER LEVEL			ACCOUNT -ING SURFACE ALTITUDE (feet, msl)	FEET ABOVE ACCOUNT -ING SURFACE
				DATE MEASURED	DEPTH (feet, bls)	ALTITUDE (feet, msl)		
(B-20-18) 22aac	---	779	2,495	8/18/2004	743.9	1,751	455	1,296
(B-20-18) 4bbb	MP-5	1,350	2,524	11/9/1995	748.6	1,775	455	1,320
(B-21-18) 34dba	GV-1	1,320	2,559	6/10/2005	764.71	1,794	455	1,339

Lastly, in order to obtain a statement of adequate water supply from ADWR, a development can not draw down the water level in the aquifer below a depth of 1,200 feet without a variance. The accounting surface is more than 2,000 feet below land surface at the Property. Therefore, wells used to withdraw groundwater under an ADWR statement of adequate water supply for the proposed development are not wells that would impact the Colorado River, according to criteria established by Wilson and Owen-Joyce (1994).

PROJECTED 100-YEAR WATER DEMAND

Projected water demands were estimated for the proposed development based on the projected number of residential units and acreages for other land uses identified by Rhodes Homes. Types of residential lots include only single family; residential water demands include interior and exterior uses. Other water demands include: interior and exterior demands for commercial property and schools, and landscaping demands for right-of-ways, easements, and parks. In addition, water demands for construction water and for lost and unaccounted for water were included. The projected total water demand following build out is estimated to be about 14,714 acre-feet per year (AF/yr). Details for the basis of the estimated water demand are included in Attachment 1 of the Application for Analysis of Adequate Water Supply.

PROJECTED 100-YEAR IMPACTS FROM GROUNDWATER PUMPING

Projections of 100-year drawdown resulting from estimated groundwater pumping for water supply at the Property were made using the computer software "THWELLS" (van der Heijde, 1996). This software solves the Theis equation to compute drawdown for up to 100 wells and uses spatially uniform values for aquifer parameters. A correction to the Theis equation was applied for simulation of unconfined aquifer conditions. Data used in the THWELLS model are discussed below and are summarized in tabular form in **Appendix D**. **Table D-1** gives the "x" and "y" model coordinates for pumping wells and image wells, and the pumping rate simulated at each well location. Locations for wells included in the simulation are shown on **Figure 5**; the well locations represent sites for pumping wells in the target aquifer system and sites for image wells representing the effects of assumed hydrologic barrier boundaries.

Based on data obtained for well GV-1 and on geophysical data for the Property area, average saturated thickness of the aquifer at the Property area is estimated to be more than 750 feet. To provide a conservatively small estimate of saturated aquifer thickness for modeling purposes, a value of 550 feet was used.

Model transmissivity was assigned a value of 55,000 gpd/ft to represent an average value for the study area for the 100-year projection. The 55,000 gpd/ft value is the product of the conservatively small average saturated aquifer thickness assigned for the Property and the geometric mean of hydraulic conductivities calculated from pumping test data for the Property area (100 gpd/ft^2).

Based on depth to bedrock contours, groundwater level contours, regional gravity survey data, and records for wells in the basin, two hydrologic barrier boundaries were simulated to represent the basin bounding faults along the east and west margins of the basin floor **(Figures 1 and 5)**. In addition, although available data do not support the existence of a hydrologic barrier boundary between the Sacramento and Detrital Valleys, such a boundary was added to the model to address concerns voiced by ADWR staff at a preliminary project meeting held on June 7, 2005.

The current average depth to groundwater at the Property is estimated to be about 755 feet bls. Therefore, it is assumed that the available groundwater level drawdown above the 1,200-foot ADWR water adequacy criterion is 445 feet.

Based on the current groundwater withdrawals at the large production wells in the area versus past withdrawals and change in groundwater levels over the last 40 years, it was considered appropriate to add a simulated regional decline of 1 ft/yr to the projected drawdown impact for the model to represent future pumping from active wells in the area.

CONCEPTUAL MODEL

The hydrologic features and pumping regimens for the conceptual groundwater model are summarized as follows:

- Barrier boundaries were assumed to be located east, west, and north from the Property, representing barriers to groundwater flow along the Black Mountains on the west, the Cerbat and Hualapai Mountains on the east, and a bedrock high hypothesized by ADWR at the surface water divide between the Sacramento and Detrital Valleys. These boundaries define an elongated triangle encompassing the Property area. Locations for the barrier boundaries are shown on **Figures 1 and 5.**

- Image wells were simulated on the opposite side of each barrier boundary.

- Saturated thickness of the aquifer was assumed to be 550 feet.

- Aquifer parameters: Transmissivity (T) = 55,000 gpd/ft
Specific Yield (S_y) = 0.07

- 10 pumping wells were simulated on the Property; each well was assigned a continuous pumping rate of 930 gpm for a total demand of 15,000 AF/yr **(Figure 5; Table D-1 in Appendix D).**

- 30 image wells were simulated in the model, and were each assigned a pumping rate of 930 gpm to represent production pumping effects **(Figure 5; Table D-1 in Appendix D).**

- Total simulation time = 100 years

- A total of 100 feet of additional drawdown was added to model results to simulate a regional decline of 1 ft/yr.

PROJECTION OF 100-YEAR GROUNDWATER LEVEL DRAWDOWN

Results of model projections for a 100-year pumping period and a total pumping rate of 15,000 AF/yr are summarized as follows:

- Simulations were conducted to project groundwater level drawdown for 100 years of pumping. Three barrier boundaries were simulated. Recharge was not included in the model projection.

- Simulations were conducted for a 100-year period. Pumping rates were based on projected future pumping rates.

- **Table D-1 and Figure 5** show the simulated drawdown caused solely by the proposed pumping at the property; the regional groundwater level decline of 1 ft/yr (100 feet over 100 years of pumping) must be added to the drawdown shown. Maximum simulated groundwater level drawdown from all sources of pumping, including the regional groundwater level decline, is about 399 feet at Pumping Well 5 **(Table D-1)**, which is the sum of the simulated drawdown due to pumping at the property (299 feet) plus 100 feet of regional groundwater level decline. Therefore, the resulting maximum depth to water after 100 years at Pumping Well 5 is projected to be about 1,154 feet bls, which is the average current depth to groundwater at the Property of 755 feet bls plus the simulated drawdown of 399 feet.

- A hydrograph of projected groundwater level drawdown for the 100-year pumping period at the point of maximum drawdown in the well field is shown on **Figure 6**. This hydrograph does not account for regional groundwater level decline.

- Projected 100-year impacts of pumping for water supply for the proposed development indicate that less than 300 feet of additional drawdown will be required to meet the needs of the development, and sufficient groundwater is available to serve the development and meet all ADWR requirements.

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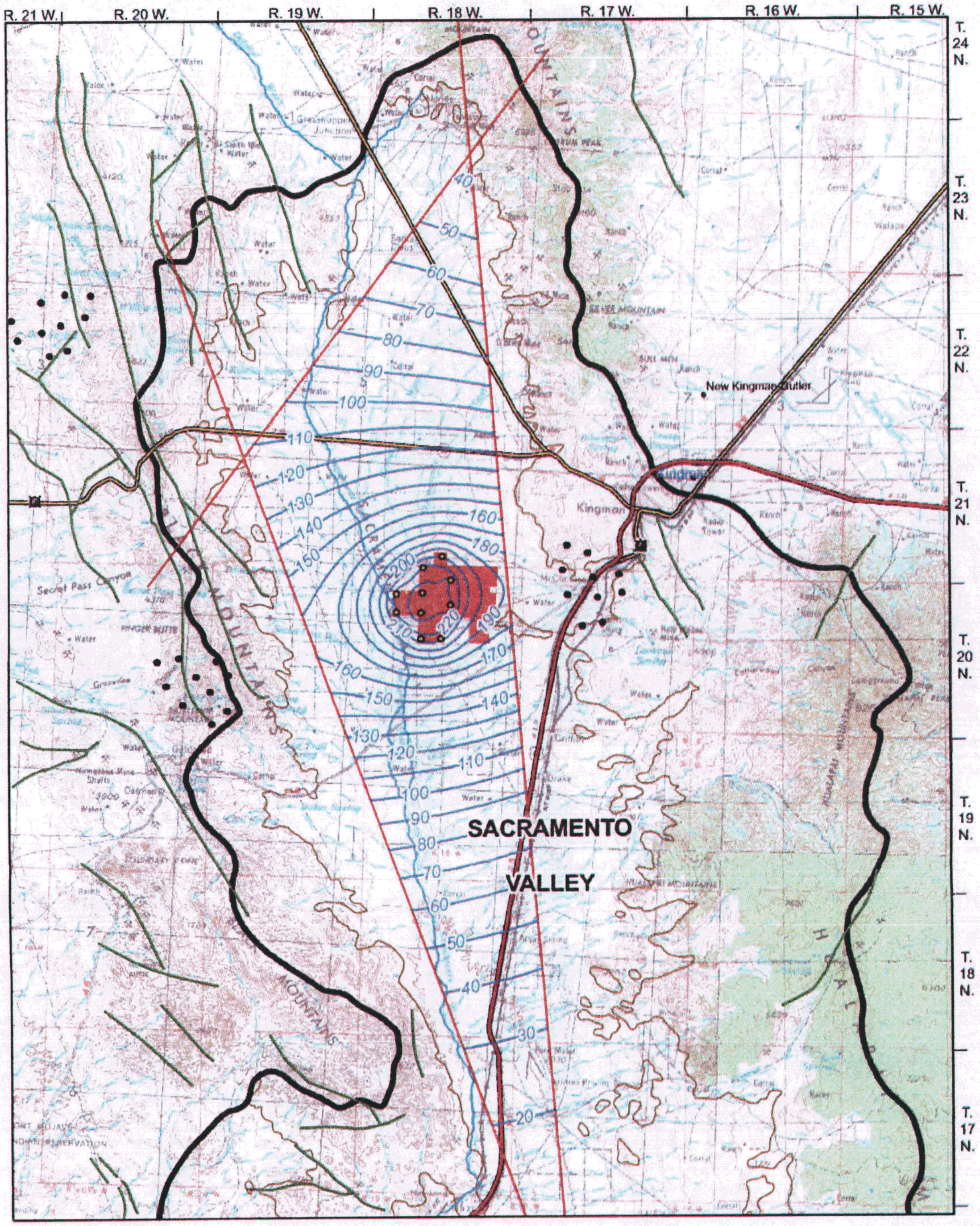

EXPLANATION

- Model Production Well
- Image Production Well
- Fault (Arizona Geological Survey Digital Information Series 08, Ver. 3.0)
- Bedrock Boundary (ADWR Hydrologic Map Series, Report No. 21, 1991)
- Boundary of Groundwater Basin (ADWR Hydrologic Map Series, Report No. 21, 1991)
- 100-Year Drawdown Contour, in feet: 15,000 Acre-Feet Per Year Pumped
- Hydrologic Model Boundary
- Golden Valley South Master Planned Community

N

0 1 2 3 4

Miles

FIGURE 5. PROJECTED GROUNDWATER LEVEL DRAWDOWN RESULTING FROM PUMPING AT GOLDEN VALLEY SOUTH

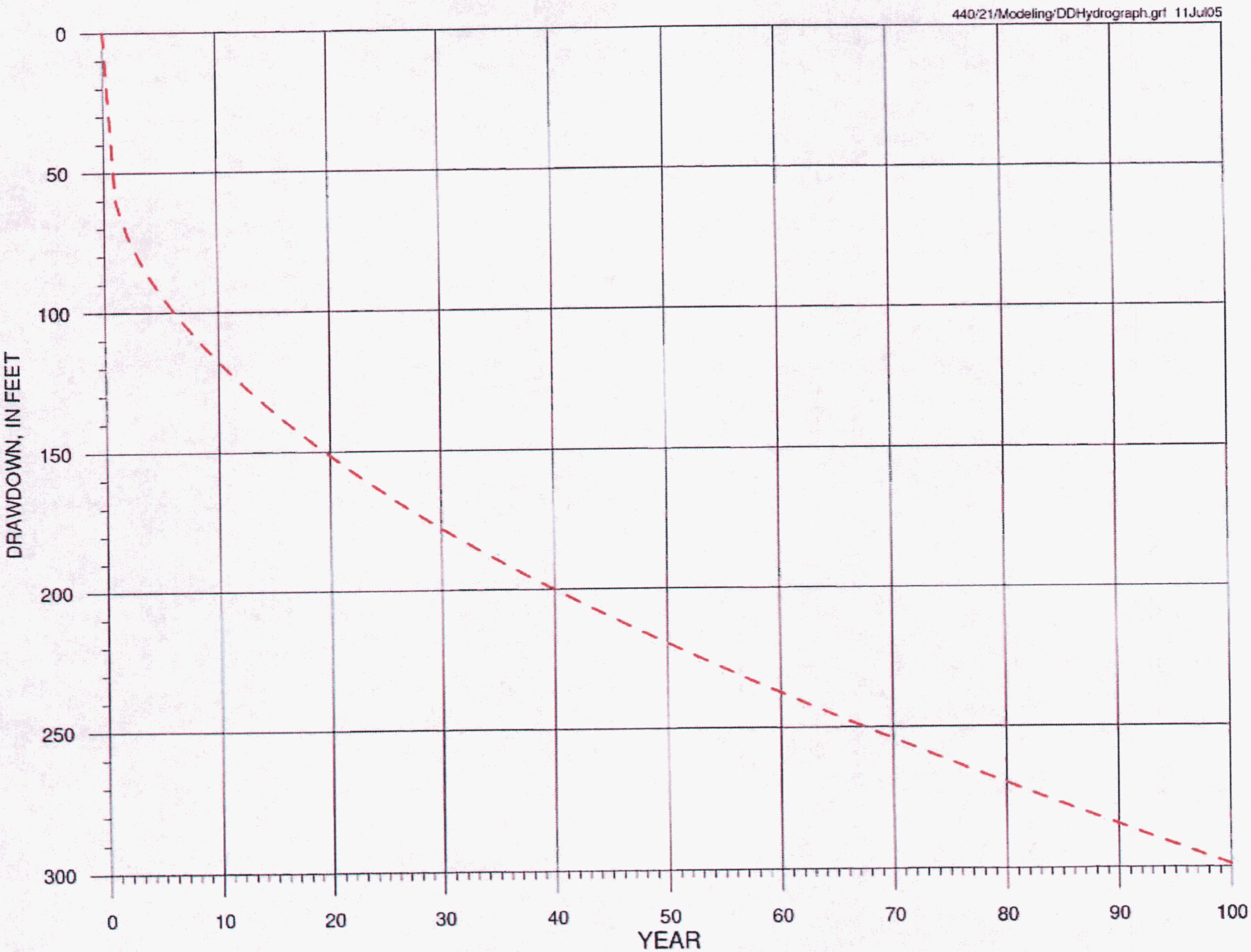

FIGURE 6. HYDROGRAPH OF GROUNDWATER LEVEL DRAWDOWN AT POINT OF MAXIMUM DRAWDOWN RESULTING FROM PUMPING 15,000 ACRE-FEET PER YEAR AT GOLDEN VALLEY SOUTH MASTER PLANNED COMMUNITY, MOHAVE COUNTY, ARIZONA

ERROL L. MONTGOMERY & ASSOCIATES, INC.

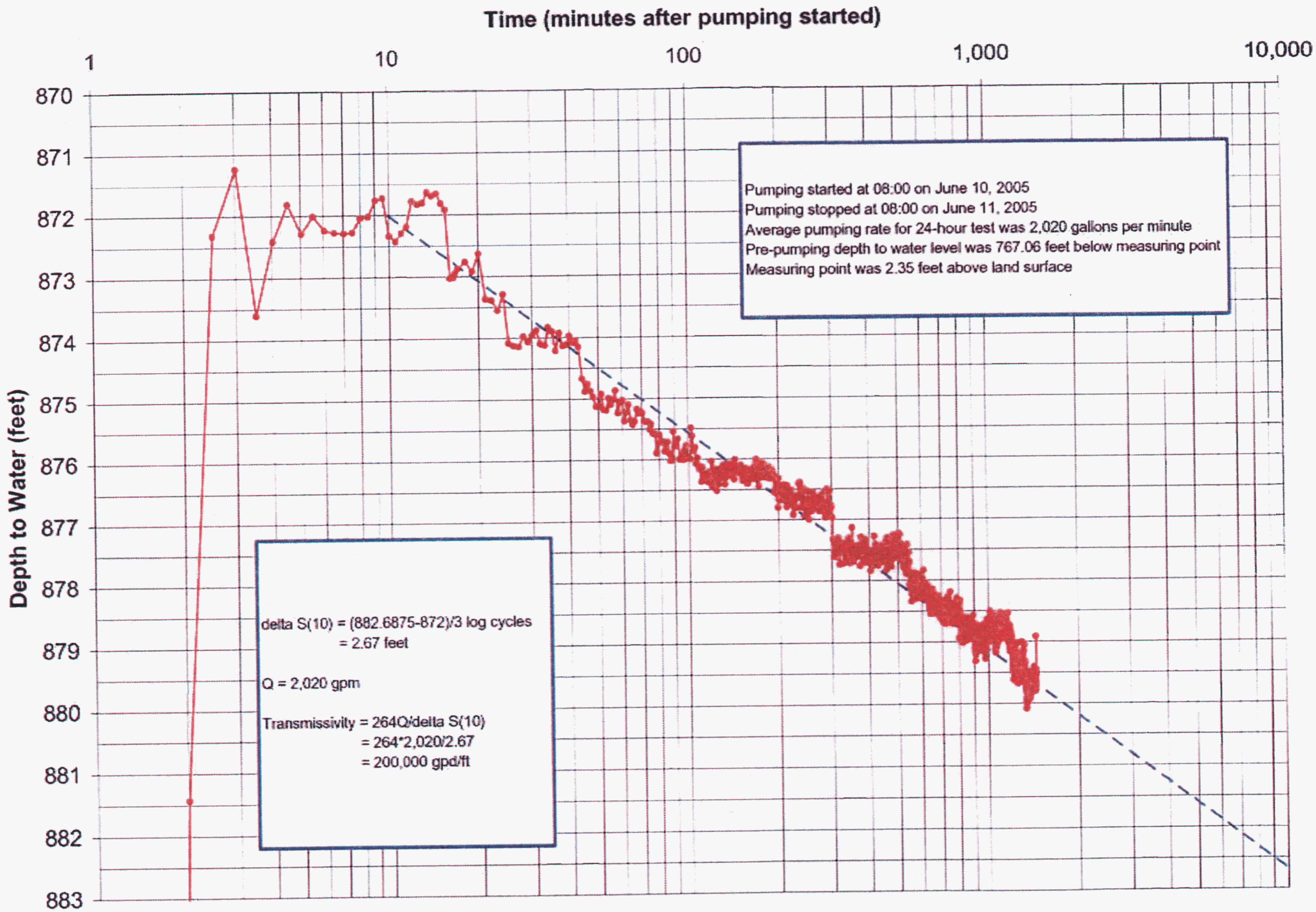

FIGURE 3. WATER LEVEL DRAWDOWN GRAPH FOR PUMPED WELL GV-1

ERROL L. MONTGOMERY & ASSOCIATES, INC.

GV-1 Aquifer Test.xls / Figure 4 - Drawdown / 7/8/2005

ERROL L. MONTGOMERY & ASSOCIATES, INC.
CONSULTANTS IN HYDROGEOLOGY

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TODD KEAY, P.G.
JAMES S. DAVIS, P.G.
MICHAEL J. ROSKO, P.G.
CHARLES F. BARTER (1937-1999)
DANIEL S. WEBER, P.G.
LESLIE T. KATZ, P.G.

July 15, 2005

RECEIVED
JUL 18 2005
OFFICE OF ASSURED WATER SUPPLY

Mr. Doug Dunham
ARIZONA DEPARTMENT OF WATER RESOURCES
Office of Assured Water Supply
500 N. 3rd Street
Phoenix, Arizona 85004

Dear Mr. Dunham:

Enclosed please find the materials that Errol L. Montgomery & Associates, Inc., has prepared on behalf of American Land Management, LLC, in support of an Analysis of Water Adequacy for the Golden Valley South Master Planned Community in Mohave County, Arizona. The materials include copies of the following documents that we are submitting for your review and approval.

1) Application for Arizona Department of Water Resources (ADWR) Analysis of Water Adequacy

2) Hydrologic Study in Support of the Analysis of Water Adequacy

3) Copies of demand calculations for a lower density and maximum density development utilizing data from ADWR and Mohave County

4) Copies of the preliminary Planned Unit Development

5) A notice of intent to serve as yet incomplete since water company negotiations are underway with various potential providers

6) Ownership documents verifying ownership of all parcels listed in item 3 as belonging to American Land Management, LLC

Although we are aware that not having the water company information finalized can result in delays to a formal application, we do wish to proceed immediately with the Analysis of Water Adequacy.

If you have any questions or require clarification of any documents in the application, please do not hesitate to contact Greg Wallace or me.

Sincerely,

ERROL L. MONTGOMERY & ASSOCIATES, INC.

William R Victor

William R. Victor, P.G.

Enclosures (2 copies)

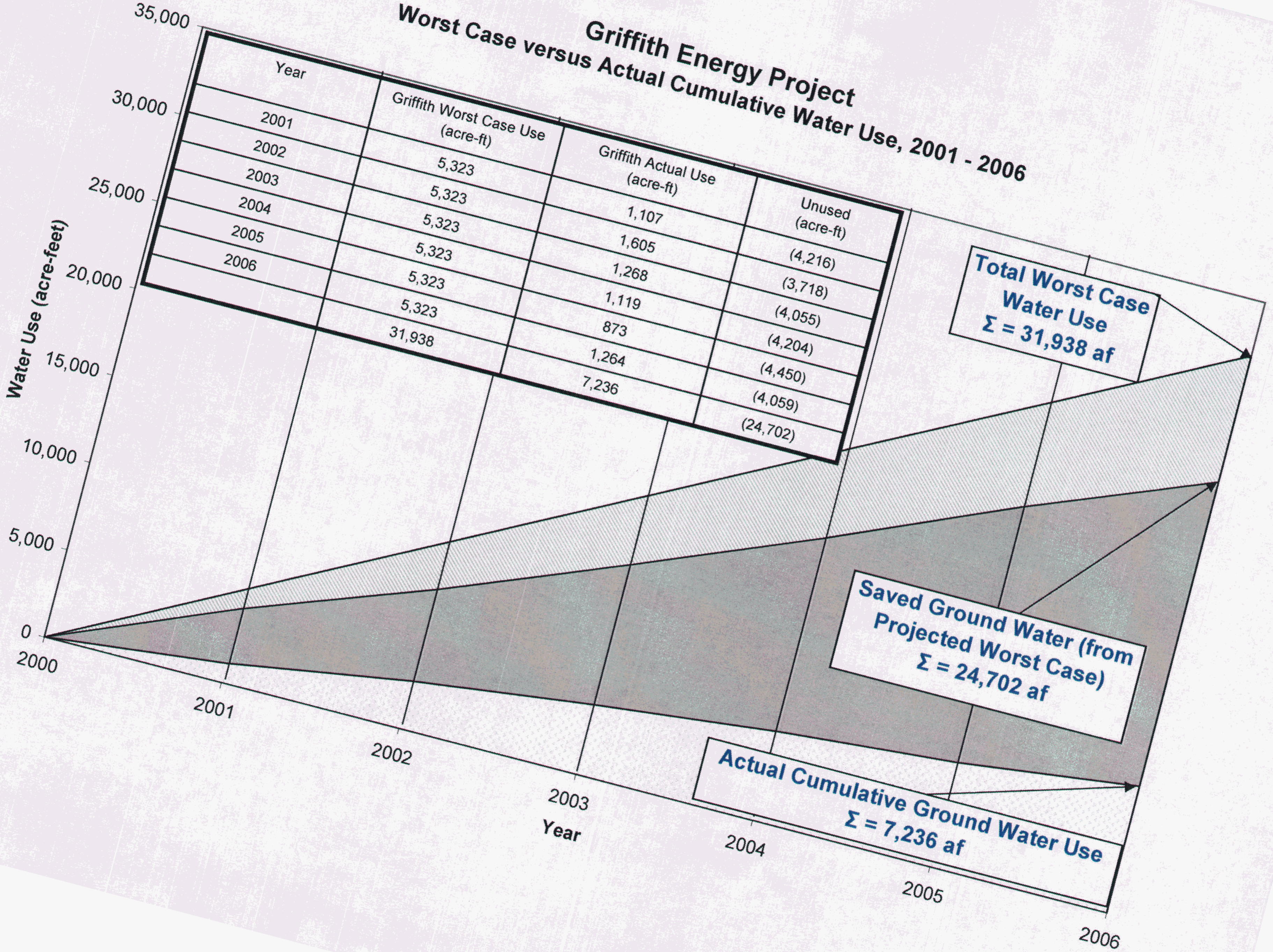
Attachment V

ATTACHMENT V

Griffith Power Plant, Actual versus Projected Cumulative Water Use, 2001 - 2006

Griffith Energy Project
Worst Case versus Actual Cumulative Water Use, 2001 - 2006

Year	Griffith Worst Case Use (acre-ft)	Griffith Actual Use (acre-ft)	Unused (acre-ft)
2001	5,323	1,107	(4,216)
2002	5,323	1,605	(3,718)
2003	5,323	1,268	(4,055)
2004	5,323	1,119	(4,204)
2005	5,323	873	(4,450)
2006	5,323	1,264	(4,059)
	31,938	7,236	(24,702)



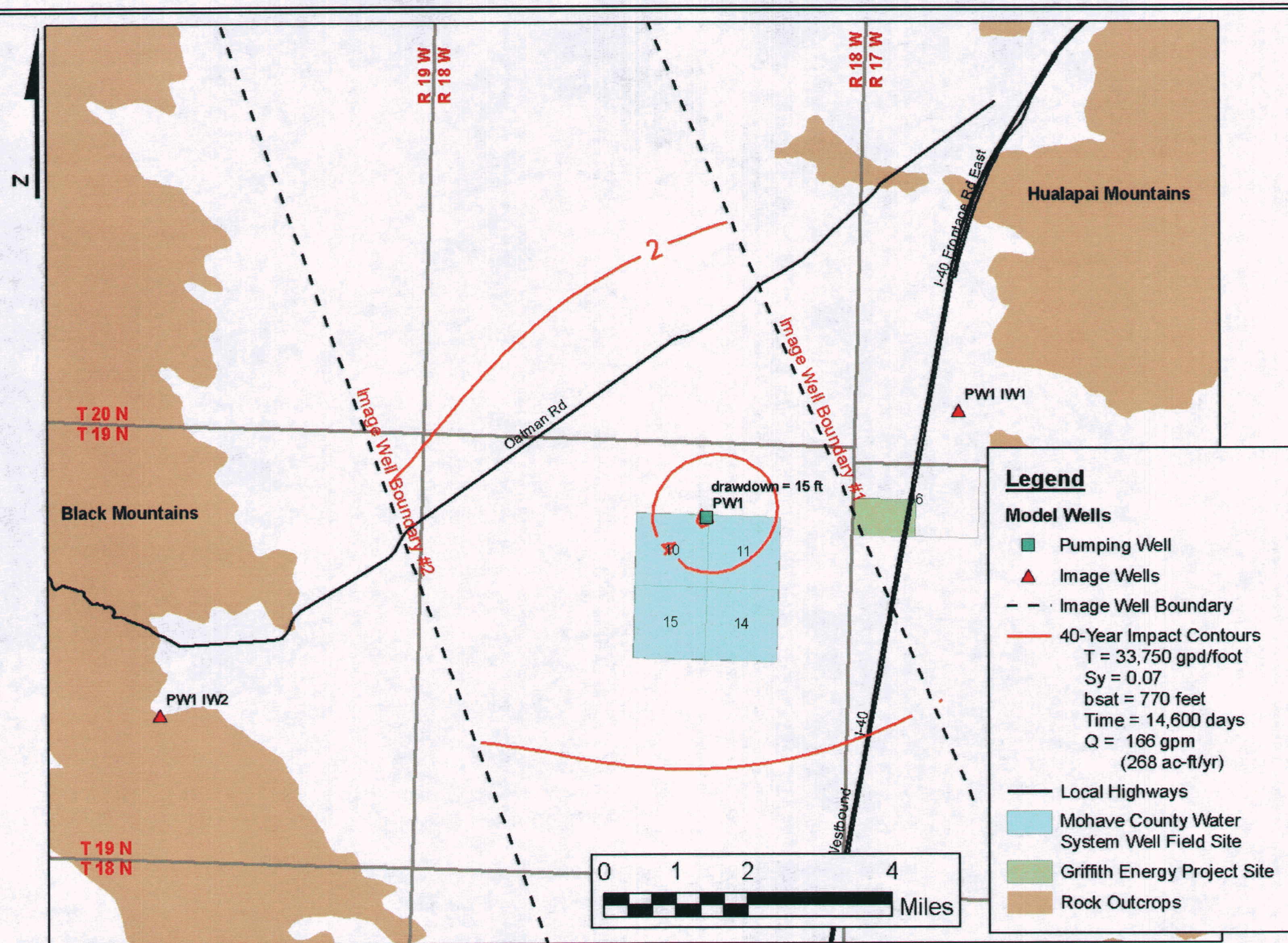
Monthly water usage - Griffith Power Plant

2006		**2005**		**2004**		**2003**		**2002**		**2001**	
Month	Gallons	Month	Gallons	Month	Gallons	Month	Gallons	Month	Gallons	Month	Gallons
Jan-06	1,696,000	Jan-05	1,785,000	Jan-04	13,675,000	Jan-03	3,471,000	Jan-02	21,574,000	Jan-01	
Feb-06	706,000	Feb-05	1,496,000	Feb-04	27,805,000	Feb-03	20,431,000	Feb-02	45,932,000	Feb-01	
Mar-06	666,000	Mar-05	3,143,000	Mar-04	11,606,000	Mar-03	3,220,000	Mar-02	36,848,000	Mar-01	6,988,000
Apr-06	1,485,000	Apr-05	937,000	Apr-04	9,524,000	Apr-03	10,282,000	Apr-02	30,323,000	Apr-01	21,550,000
May-06	320,000	May-05	1,075,000	May-04	43,444,000	May-03	33,205,000	May-02	22,615,000	May-01	35,339,000
Jun-06	7,128,000	Jun-05	41,748,000	Jun-04	52,423,000	Jun-03	43,017,000	Jun-02	71,475,000	Jun-01	78,731,000
Jul-06	37,712,000	Jul-05	88,589,000	Jul-04	80,363,000	Jul-03	81,296,000	Jul-02	78,456,000	Jul-01	12,123,000
Aug-06	101,325,000	Aug-05	84,769,000	Aug-04	79,090,000	Aug-03	83,867,000	Aug-02	75,958,000	Aug-01	64,300,000
Sep-06	86,280,000	Sep-05	27,631,000	Sep-04	35,012,000	Sep-03	62,375,000	Sep-02	56,920,000	Sep-01	47,256,000
Oct-06	78,776,000	Oct-05	3,566,000	Oct-04	9,862,000	Oct-03	60,481,000	Oct-02	26,193,000	Oct-01	44,410,000
Nov-06	53,232,000	Nov-05	7,257,000	Nov-04	241,000	Nov-03	9,353,000	Nov-02	27,897,000	Nov-01	41,567,000
Dec-06	42,667,000	Dec-05	22,449,000	Dec-04	1,668,000	Dec-03	2,298,000	Dec-02	28,771,000	Dec-01	8,402,000
	411,993,000 GALLONS		284,445,000 GALLONS		364,713,000 GALLONS		413,296,000 GALLONS		522,962,000 GALLONS		360,666,000 GALLONS
	1,128,748 GPD		779,301 GPD		996,484 GPD		1,132,318 GPD		1,432,773 GPD		1,178,647 GPD
Jul-06	37,712,000	Jul-05	88,589,000	Jul-04	80,363,000	Jul-03	81,296,000	Jul-02	78,456,000	Jul-01	12,123,000
Aug-06	101,325,000	Aug-05	84,769,000	Aug-04	79,090,000	Aug-03	83,867,000	Aug-02	75,958,000	Aug-01	64,300,000
Sep-06	86,280,000	Sep-05	27,631,000	Sep-04	35,012,000	Sep-03	62,375,000	Sep-02	56,920,000	Sep-01	47,256,000
Oct-06	78,776,000	Oct-05	3,566,000	Oct-04	9,862,000	Oct-03	60,481,000	Oct-02	26,193,000	Oct-01	44,410,000
Nov-06	53,232,000	Nov-05	7,257,000	Nov-04	241,000	Nov-03	9,353,000	Nov-02	27,897,000	Nov-01	41,567,000
Dec-06	42,667,000	Dec-05	22,449,000	Dec-04	1,688,000	Dec-03	2,298,000	Dec-02	28,771,000	Dec-01	8,402,000
Jan-07		Jan-06	1,696,000	Jan-05	1,785,000	Jan-04	13,675,000	Jan-03	3,471,000	Jan-02	21,574,000
Feb-07		Feb-06	706,000	Feb-05	1,496,000	Feb-04	27,805,000	Feb-03	20,431,000	Feb-02	45,932,000
Mar-07		Mar-06	666,000	Mar-05	3,143,000	Mar-04	11,606,000	Mar-03	3,220,000	Mar-02	36,848,000
Apr-07		Apr-06	1,485,000	Apr-05	937,000	Apr-04	9,524,000	Apr-03	10,282,000	Apr-02	30,323,000
May-07		May-06	320,000	May-05	1,075,000	May-04	43,444,000	May-03	33,205,000	May-02	22,615,000
Jun-07		Jun-06	7,128,000	Jun-05	41,748,000	Jun-04	52,423,000	Jun-03	43,017,000	Jun-02	71,475,000
	399,992,000 GALLONS		246,262,000 GALLONS		256,440,000 GALLONS		458,147,000 GALLONS		407,821,000 GALLONS		446,825,000 GALLONS
/MONTH	66,665,333 GALLONS/MONTH		20,521,833 GALLONS/MONTH		21,370,000 GALLONS/MONTH		38,178,917 GALLONS/MONTH		33,985,083 GALLONS/MONTH		37,235,417 GALLONS/MONTH

Attachment VI

ATTACHMENT VI

Figure 2 - NAEP Impact Analysis



Southwest Ground-water Consultants, Inc.

April 27, 2007 Project B.1476

NAEP IMPACT ANALYSIS

Mohave County Water System Well Field, Mohave County, Arizona

Figure 2

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION WELLS AND UNIFORM REGIONAL FLOW

NAEP Impact Analysis

********************************* INPUT DATA *********************************

UNCONFINED AQUIFER - THEIS EQUATION WITH JACOB'S CORRECTION

WATER TABLE CORRECTION APPLIED

AQUIFER THICKNESS = 770 [ft]
TRANSMISSIVITY = 33750 [gpd/ft]

STORAGE COEFFICIENT = .07

REGIONAL FLOW GRADIENT
(positive--downwards--in flow direction) = 0

REGIONAL FLOW DIRECTION
(horizontal angle in degrees
counter-clockwise from positive x-axis) = 0

REGIONAL FLOW OFFSET AT ORIGIN
(positive in downwards direction) = 0 [ft]

WATER TABLE CORRECTION APPLIED

AQUIFER THICKNESS = 770 [ft]

PUMPING/INJECTION WELL DATA

WELL NO. 1

```
                     X-COORDINATE  =  690352 [ft]
                     Y-COORDINATE  =  1.274154E+07 [ft]
           PUMPING/INJECTION RATE  =  239040 [gpd]
TIME SINCE START PUMPING/INJECTION =  14600 [day]
```

WELL NO. 2

```
                     X-COORDINATE  =  708931 [ft]
                     Y-COORDINATE  =  1.274927E+07 [ft]
           PUMPING/INJECTION RATE  =  239040 [gpd]
TIME SINCE START PUMPING/INJECTION =  14600 [day]
```

WELL NO. 3

```
                     X-COORDINATE  =  650185 [ft]
                     Y-COORDINATE  =  1.272723E+07 [ft]
           PUMPING/INJECTION RATE  =  239040 [gpd]
TIME SINCE START PUMPING/INJECTION =  14600 [day]
```

------------------------------ Drawdown in [ft] ------------------------------

Y [ft]	<- X [ft] ->					
	636109	637209	638309	639409	640509	641609
%12686183.00	0.379	0.388	0.396	0.404	0.412	0.420
%12687283.00	0.399	0.408	0.417	0.426	0.434	0.442
%12688383.00	0.420	0.429	0.439	0.448	0.457	0.466
%12689483.00	0.441	0.452	0.462	0.472	0.481	0.491
%12690583.00	0.464	0.475	0.486	0.496	0.507	0.517
%12691683.00	0.487	0.499	0.511	0.522	0.533	0.544
%12692783.00	0.512	0.524	0.537	0.549	0.561	0.572
%12693883.00	0.537	0.551	0.564	0.577	0.590	0.602
%12694983.00	0.564	0.578	0.593	0.607	0.620	0.633
%12696083.00	0.591	0.607	0.622	0.637	0.652	0.665
%12697183.00	0.620	0.637	0.653	0.669	0.685	0.699
%12698283.00	0.650	0.668	0.685	0.703	0.719	0.735
%12699383.00	0.681	0.700	0.719	0.737	0.755	0.772
%12700483.00	0.713	0.734	0.754	0.774	0.793	0.811
%12701583.00	0.746	0.769	0.790	0.811	0.832	0.852
%12702683.00	0.781	0.805	0.828	0.851	0.873	0.894
%12703783.00	0.817	0.842	0.867	0.892	0.916	0.939
%12704883.00	0.854	0.881	0.908	0.935	0.961	0.985
%12705983.00	0.892	0.921	0.951	0.979	1.007	1.034
%12707083.00	0.931	0.963	0.995	1.026	1.056	1.085
%12708183.00	0.971	1.006	1.040	1.074	1.107	1.138
%12709283.00	1.013	1.050	1.087	1.124	1.160	1.194
%12710383.00	1.055	1.096	1.136	1.175	1.215	1.253
%12711483.00	1.099	1.142	1.186	1.229	1.272	1.313
%12712583.00	1.142	1.190	1.237	1.284	1.331	1.377
%12713683.00	1.187	1.238	1.289	1.341	1.392	1.443
%12714783.00	1.231	1.286	1.342	1.399	1.456	1.512
%12715883.00	1.276	1.335	1.396	1.458	1.521	1.583
%12716983.00	1.319	1.384	1.450	1.518	1.587	1.657
%12718083.00	1.362	1.431	1.503	1.578	1.654	1.732
%12719183.00	1.403	1.477	1.555	1.636	1.721	1.807
%12720283.00	1.441	1.521	1.605	1.693	1.786	1.883
%12721383.00	1.477	1.561	1.651	1.747	1.849	1.956
%12722483.00	1.508	1.598	1.693	1.796	1.906	2.025
%12723583.00	1.535	1.629	1.729	1.838	1.957	2.086
%12724683.00	1.557	1.653	1.758	1.873	1.998	2.137
%12725783.00	1.572	1.671	1.779	1.897	2.028	2.174
%12726883.00	1.581	1.681	1.791	1.911	2.044	2.193
%12727983.00	1.583	1.684	1.793	1.913	2.046	2.195

Y [ft]	<- X [ft] -> 636109	637209	638309	639409	640509	641609
%12729083.00	1.579	1.678	1.786	1.904	2.034	2.178
%12730183.00	1.568	1.665	1.770	1.884	2.009	2.146
%12731283.00	1.551	1.645	1.746	1.855	1.973	2.101
%12732383.00	1.529	1.619	1.715	1.818	1.928	2.046
%12733483.00	1.503	1.589	1.679	1.775	1.877	1.984
%12734583.00	1.473	1.554	1.639	1.728	1.822	1.919
%12735683.00	1.440	1.516	1.596	1.678	1.764	1.852
%12736783.00	1.404	1.476	1.550	1.627	1.705	1.785
%12737883.00	1.367	1.434	1.503	1.574	1.646	1.719
%12738983.00	1.329	1.392	1.456	1.522	1.588	1.655
%12740083.00	1.290	1.349	1.409	1.470	1.531	1.592
%12741183.00	1.251	1.306	1.362	1.418	1.475	1.531
%12742283.00	1.212	1.263	1.316	1.368	1.421	1.473
%12743383.00	1.173	1.221	1.270	1.319	1.368	1.417
%12744483.00	1.134	1.180	1.226	1.272	1.318	1.363
%12745583.00	1.096	1.139	1.183	1.226	1.269	1.312
%12746683.00	1.059	1.100	1.141	1.181	1.222	1.262
%12747783.00	1.023	1.061	1.100	1.138	1.176	1.214
%12748883.00	0.987	1.024	1.060	1.096	1.133	1.169
%12749983.00	0.953	0.987	1.022	1.056	1.090	1.125
%12751083.00	0.919	0.952	0.984	1.017	1.050	1.082
%12752183.00	0.886	0.917	0.948	0.979	1.011	1.041
%12753283.00	0.854	0.884	0.913	0.943	0.973	1.002
%12754383.00	0.823	0.851	0.879	0.908	0.936	0.964
%12755483.00	0.793	0.820	0.847	0.874	0.901	0.928
%12756583.00	0.763	0.789	0.815	0.841	0.867	0.893
%12757683.00	0.735	0.759	0.784	0.809	0.834	0.859
%12758783.00	0.707	0.731	0.754	0.778	0.802	0.826
%12759883.00	0.680	0.703	0.726	0.748	0.771	0.794
%12760983.00	0.654	0.676	0.698	0.720	0.742	0.764
%12762083.00	0.629	0.650	0.671	0.692	0.713	0.734
%12763183.00	0.605	0.625	0.645	0.665	0.685	0.705
%12764283.00	0.581	0.600	0.619	0.638	0.658	0.678
%12765383.00	0.558	0.576	0.595	0.613	0.632	0.651
%12766483.00	0.536	0.553	0.571	0.589	0.607	0.625
%12767583.00	0.514	0.531	0.548	0.565	0.582	0.600
%12768683.00	0.494	0.510	0.526	0.542	0.559	0.575
%12769783.00	0.473	0.489	0.504	0.520	0.536	0.552
%12770883.00	0.454	0.469	0.483	0.498	0.514	0.529
%12771983.00	0.435	0.449	0.463	0.478	0.492	0.507

Y [ft]	636109	637209	638309	639409	640509	641609
%12773083.00	0.417	0.430	0.444	0.458	0.472	0.486
%12774183.00	0.399	0.412	0.425	0.438	0.452	0.465
%12775283.00	0.382	0.394	0.407	0.419	0.432	0.445

<- X [ft] ->

Y [ft]	642709	643809	644909	646009	647109	648209
%12686183.00	0.427	0.434	0.440	0.447	0.452	0.458
%12687283.00	0.450	0.457	0.464	0.471	0.477	0.483
%12688383.00	0.474	0.482	0.490	0.497	0.503	0.509
%12689483.00	0.500	0.508	0.516	0.523	0.530	0.537
%12690583.00	0.526	0.535	0.543	0.551	0.559	0.566
%12691683.00	0.554	0.563	0.572	0.581	0.589	0.596
%12692783.00	0.583	0.593	0.603	0.612	0.620	0.628
%12693883.00	0.613	0.624	0.635	0.644	0.653	0.661
%12694983.00	0.645	0.657	0.668	0.678	0.688	0.697
%12696083.00	0.679	0.691	0.703	0.714	0.724	0.733
%12697183.00	0.713	0.727	0.740	0.751	0.762	0.772
%12698283.00	0.750	0.764	0.778	0.791	0.802	0.813
%12699383.00	0.788	0.804	0.818	0.832	0.844	0.855
%12700483.00	0.829	0.845	0.861	0.875	0.888	0.900
%12701583.00	0.871	0.888	0.905	0.920	0.935	0.947
%12702683.00	0.915	0.934	0.952	0.968	0.983	0.997
%12703783.00	0.961	0.981	1.001	1.019	1.035	1.049
%12704883.00	1.009	1.031	1.052	1.072	1.089	1.105
%12705983.00	1.060	1.084	1.107	1.128	1.146	1.163
%12707083.00	1.113	1.139	1.164	1.187	1.207	1.225
%12708183.00	1.169	1.198	1.224	1.249	1.271	1.290
%12709283.00	1.227	1.259	1.288	1.315	1.339	1.360
%12710383.00	1.289	1.324	1.356	1.385	1.411	1.434
%12711483.00	1.354	1.392	1.427	1.460	1.488	1.513
%12712583.00	1.421	1.464	1.503	1.539	1.571	1.598
%12713683.00	1.492	1.540	1.584	1.624	1.659	1.689
%12714783.00	1.567	1.620	1.669	1.714	1.754	1.788
%12715883.00	1.645	1.704	1.760	1.812	1.857	1.895
%12716983.00	1.726	1.793	1.857	1.917	1.969	2.012
%12718083.00	1.810	1.887	1.961	2.030	2.091	2.141
%12719183.00	1.896	1.984	2.070	2.152	2.225	2.285
%12720283.00	1.983	2.085	2.186	2.284	2.373	2.447
%12721383.00	2.069	2.187	2.307	2.426	2.537	2.631
%12722483.00	2.152	2.287	2.430	2.576	2.719	2.845
%12723583.00	2.227	2.382	2.550	2.731	2.918	3.095
%12724683.00	2.291	2.464	2.658	2.879	3.126	3.388
%12725783.00	2.337	2.524	2.742	3.000	3.315	3.706

Y [ft]	<- X [ft] ->					
	642709	643809	644909	646009	647109	648209
%12726883.00	2.362	2.557	2.786	3.067	3.429	3.940
%12727983.00	2.363	2.556	2.784	3.059	3.410	3.888
%12729083.00	2.340	2.524	2.735	2.983	3.275	3.615
%12730183.00	2.298	2.466	2.653	2.861	3.088	3.316
%12731283.00	2.239	2.390	2.551	2.722	2.895	3.053
%12732383.00	2.171	2.303	2.441	2.581	2.715	2.832
%12733483.00	2.096	2.212	2.330	2.445	2.552	2.644
%12734583.00	2.019	2.121	2.222	2.319	2.407	2.482
%12735683.00	1.942	2.032	2.119	2.202	2.277	2.341
%12736783.00	1.866	1.945	2.022	2.095	2.160	2.216
%12737883.00	1.792	1.863	1.931	1.995	2.053	2.103
%12738983.00	1.721	1.785	1.846	1.904	1.956	2.002
%12740083.00	1.652	1.711	1.767	1.819	1.867	1.909
%12741183.00	1.587	1.640	1.692	1.740	1.784	1.824
%12742283.00	1.524	1.574	1.621	1.666	1.708	1.746
%12743383.00	1.465	1.511	1.555	1.597	1.636	1.672
%12744483.00	1.408	1.451	1.492	1.532	1.569	1.604
%12745583.00	1.353	1.394	1.433	1.471	1.506	1.540
%12746683.00	1.301	1.340	1.377	1.412	1.447	1.479
%12747783.00	1.251	1.288	1.323	1.357	1.390	1.422
%12748883.00	1.204	1.238	1.272	1.305	1.337	1.367
%12749983.00	1.158	1.191	1.223	1.255	1.285	1.315
%12751083.00	1.114	1.146	1.177	1.207	1.237	1.265
%12752183.00	1.072	1.102	1.132	1.161	1.190	1.218
%12753283.00	1.032	1.061	1.089	1.117	1.145	1.172
%12754383.00	0.992	1.020	1.048	1.075	1.102	1.129
%12755483.00	0.955	0.982	1.008	1.035	1.061	1.087
%12756583.00	0.919	0.944	0.970	0.996	1.021	1.046
%12757683.00	0.884	0.909	0.933	0.958	0.982	1.007
%12758783.00	0.850	0.874	0.898	0.922	0.945	0.969
%12759883.00	0.817	0.840	0.863	0.886	0.909	0.933
%12760983.00	0.786	0.808	0.830	0.852	0.875	0.897
%12762083.00	0.755	0.777	0.798	0.820	0.841	0.863
%12763183.00	0.726	0.746	0.767	0.788	0.809	0.830
%12764283.00	0.697	0.717	0.737	0.757	0.777	0.798
%12765383.00	0.670	0.689	0.708	0.727	0.747	0.767
%12766483.00	0.643	0.661	0.680	0.699	0.718	0.737
%12767583.00	0.617	0.635	0.653	0.671	0.689	0.708
%12768683.00	0.592	0.609	0.627	0.644	0.662	0.679
%12769783.00	0.568	0.584	0.601	0.618	0.635	0.652

Y [ft]	<- X [ft] ->					
	642709	643809	644909	646009	647109	648209
%12770883.00	0.545	0.560	0.576	0.593	0.609	0.625
%12771983.00	0.522	0.537	0.553	0.568	0.584	0.600
%12773083.00	0.500	0.515	0.530	0.545	0.560	0.575
%12774183.00	0.479	0.493	0.507	0.522	0.536	0.551
%12775283.00	0.459	0.472	0.486	0.499	0.513	0.528

Y [ft]	<- X [ft] ->					
	649309	650409	651509	652609	653709	654809
%12686183.00	0.463	0.467	0.471	0.475	0.478	0.481
%12687283.00	0.488	0.493	0.497	0.501	0.505	0.508
%12688383.00	0.515	0.520	0.525	0.529	0.532	0.535
%12689483.00	0.543	0.548	0.553	0.557	0.561	0.565
%12690583.00	0.572	0.578	0.583	0.588	0.592	0.595
%12691683.00	0.603	0.609	0.614	0.619	0.623	0.627
%12692783.00	0.635	0.642	0.647	0.652	0.657	0.660
%12693883.00	0.669	0.676	0.682	0.687	0.692	0.695
%12694983.00	0.705	0.712	0.718	0.724	0.728	0.732
%12696083.00	0.742	0.749	0.756	0.762	0.767	0.771
%12697183.00	0.781	0.789	0.796	0.802	0.807	0.811
%12698283.00	0.822	0.831	0.838	0.844	0.849	0.853
%12699383.00	0.865	0.874	0.882	0.888	0.894	0.898
%12700483.00	0.911	0.920	0.928	0.935	0.940	0.944
%12701583.00	0.959	0.968	0.977	0.984	0.989	0.993
%12702683.00	1.009	1.019	1.028	1.035	1.041	1.045
%12703783.00	1.062	1.073	1.082	1.089	1.095	1.099
%12704883.00	1.118	1.130	1.139	1.146	1.152	1.155
%12705983.00	1.177	1.189	1.199	1.207	1.212	1.215
%12707083.00	1.240	1.253	1.263	1.270	1.275	1.278
%12708183.00	1.307	1.320	1.330	1.338	1.342	1.344
%12709283.00	1.377	1.391	1.402	1.409	1.413	1.414
%12710383.00	1.453	1.467	1.478	1.485	1.488	1.488
%12711483.00	1.533	1.549	1.560	1.566	1.568	1.567
%12712583.00	1.620	1.636	1.647	1.653	1.654	1.650
%12713683.00	1.713	1.730	1.741	1.746	1.745	1.738
%12714783.00	1.814	1.832	1.843	1.846	1.842	1.832
%12715883.00	1.924	1.943	1.953	1.954	1.947	1.933
%12716983.00	2.045	2.065	2.075	2.072	2.060	2.040
%12718083.00	2.178	2.201	2.209	2.202	2.183	2.155
%12719183.00	2.329	2.353	2.358	2.345	2.317	2.278
%12720283.00	2.500	2.527	2.528	2.505	2.463	2.409
%12721383.00	2.698	2.730	2.723	2.684	2.622	2.547
%12722483.00	2.935	2.973	2.954	2.888	2.795	2.692
%12723583.00	3.229	3.279	3.234	3.120	2.979	2.837

Y [ft]	<- X [ft] ->					
	649309	650409	651509	652609	653709	654809
%12724683.00	3.611	3.692	3.584	3.379	3.164	2.972
%12725783.00	4.146	4.331	4.024	3.637	3.325	3.081
%12726883.00	4.818	5.773	4.442	3.809	3.418	3.142
%12727983.00	4.597	5.059	4.331	3.778	3.409	3.142
%12729083.00	3.954	4.085	3.884	3.580	3.307	3.084
%12730183.00	3.501	3.570	3.495	3.335	3.155	2.986
%12731283.00	3.172	3.221	3.192	3.105	2.989	2.868
%12732383.00	2.917	2.958	2.950	2.902	2.829	2.744
%12733483.00	2.711	2.747	2.751	2.726	2.680	2.623
%12734583.00	2.538	2.572	2.583	2.572	2.545	2.507
%12735683.00	2.390	2.422	2.437	2.437	2.423	2.399
%12736783.00	2.260	2.291	2.310	2.316	2.311	2.299
%12737883.00	2.144	2.175	2.196	2.207	2.210	2.206
%12738983.00	2.040	2.071	2.093	2.108	2.116	2.118
%12740083.00	1.946	1.976	2.000	2.017	2.029	2.037
%12741183.00	1.859	1.889	1.914	1.934	1.949	1.961
%12742283.00	1.779	1.809	1.835	1.856	1.874	1.889
%12743383.00	1.705	1.735	1.761	1.783	1.803	1.821
%12744483.00	1.636	1.665	1.692	1.715	1.737	1.756
%12745583.00	1.571	1.600	1.626	1.651	1.674	1.695
%12746683.00	1.510	1.538	1.565	1.590	1.614	1.636
%12747783.00	1.451	1.480	1.507	1.532	1.557	1.580
%12748883.00	1.396	1.424	1.451	1.477	1.502	1.526
%12749983.00	1.344	1.371	1.398	1.424	1.449	1.474
%12751083.00	1.293	1.321	1.347	1.373	1.399	1.424
%12752183.00	1.245	1.272	1.299	1.324	1.350	1.375
%12753283.00	1.199	1.226	1.252	1.277	1.303	1.328
%12754383.00	1.155	1.181	1.206	1.232	1.257	1.283
%12755483.00	1.112	1.138	1.163	1.188	1.213	1.238
%12756583.00	1.071	1.096	1.121	1.145	1.170	1.195
%12757683.00	1.031	1.056	1.080	1.104	1.129	1.153
%12758783.00	0.993	1.017	1.040	1.064	1.088	1.112
%12759883.00	0.956	0.979	1.002	1.025	1.049	1.073
%12760983.00	0.920	0.942	0.965	0.988	1.011	1.034
%12762083.00	0.885	0.907	0.929	0.951	0.974	0.996
%12763183.00	0.851	0.872	0.894	0.916	0.938	0.960
%12764283.00	0.818	0.839	0.860	0.881	0.902	0.924
%12765383.00	0.787	0.807	0.827	0.848	0.868	0.889
%12766483.00	0.756	0.775	0.795	0.815	0.835	0.856
%12767583.00	0.726	0.745	0.764	0.783	0.803	0.823

Y [ft]	<- X [ft] ->					
	649309	650409	651509	652609	653709	654809
%12768683.00	0.697	0.715	0.734	0.753	0.771	0.791
%12769783.00	0.669	0.687	0.705	0.723	0.741	0.760
%12770883.00	0.642	0.659	0.676	0.694	0.711	0.729
%12771983.00	0.616	0.632	0.649	0.666	0.683	0.700
%12773083.00	0.590	0.606	0.622	0.638	0.655	0.671
%12774183.00	0.566	0.581	0.596	0.612	0.628	0.644
%12775283.00	0.542	0.557	0.571	0.586	0.601	0.617

Y [ft]	<- X [ft] ->					
	655909	657009	658109	659209	660309	661409
%12686183.00	0.484	0.486	0.487	0.489	0.489	0.490
%12687283.00	0.510	0.512	0.514	0.515	0.516	0.517
%12688383.00	0.538	0.540	0.542	0.543	0.544	0.544
%12689483.00	0.567	0.569	0.571	0.572	0.573	0.574
%12690583.00	0.598	0.600	0.602	0.603	0.604	0.604
%12691683.00	0.630	0.632	0.634	0.635	0.636	0.636
%12692783.00	0.663	0.666	0.667	0.669	0.669	0.669
%12693883.00	0.698	0.701	0.702	0.704	0.704	0.704
%12694983.00	0.735	0.738	0.739	0.740	0.740	0.740
%12696083.00	0.774	0.776	0.778	0.778	0.779	0.778
%12697183.00	0.814	0.816	0.818	0.818	0.818	0.818
%12698283.00	0.856	0.859	0.860	0.860	0.860	0.859
%12699383.00	0.901	0.903	0.904	0.904	0.903	0.902
%12700483.00	0.947	0.949	0.950	0.950	0.948	0.947
%12701583.00	0.996	0.998	0.998	0.997	0.996	0.993
%12702683.00	1.047	1.048	1.048	1.047	1.045	1.042
%12703783.00	1.101	1.101	1.101	1.099	1.096	1.092
%12704883.00	1.157	1.157	1.156	1.153	1.149	1.145
%12705983.00	1.216	1.216	1.213	1.210	1.205	1.199
%12707083.00	1.278	1.277	1.274	1.269	1.263	1.256
%12708183.00	1.344	1.341	1.336	1.330	1.323	1.315
%12709283.00	1.413	1.408	1.402	1.394	1.385	1.375
%12710383.00	1.485	1.479	1.471	1.461	1.450	1.438
%12711483.00	1.562	1.553	1.543	1.531	1.517	1.503
%12712583.00	1.642	1.631	1.618	1.603	1.586	1.569
%12713683.00	1.727	1.713	1.696	1.678	1.658	1.637
%12714783.00	1.818	1.799	1.778	1.755	1.731	1.707
%12715883.00	1.913	1.889	1.863	1.835	1.806	1.778
%12716983.00	2.014	1.983	1.950	1.916	1.882	1.849
%12718083.00	2.120	2.081	2.040	1.999	1.959	1.920
%12719183.00	2.232	2.182	2.132	2.082	2.035	1.991
%12720283.00	2.348	2.285	2.224	2.165	2.110	2.059
%12721383.00	2.468	2.389	2.314	2.245	2.181	2.124

Y [ft]	<- X [ft] ->					
	655909	657009	658109	659209	660309	661409
%12722483.00	2.588	2.491	2.401	2.320	2.248	2.185
%12723583.00	2.704	2.585	2.480	2.388	2.308	2.239
%12724683.00	2.807	2.667	2.547	2.446	2.359	2.285
%12725783.00	2.887	2.729	2.599	2.490	2.399	2.322
%12726883.00	2.932	2.766	2.631	2.519	2.427	2.349
%12727983.00	2.937	2.774	2.641	2.532	2.441	2.365
%12729083.00	2.902	2.753	2.630	2.527	2.441	2.370
%12730183.00	2.837	2.709	2.600	2.508	2.430	2.364
%12731283.00	2.752	2.648	2.556	2.476	2.407	2.349
%12732383.00	2.658	2.576	2.501	2.434	2.376	2.326
%12733483.00	2.560	2.498	2.439	2.385	2.337	2.297
%12734583.00	2.463	2.418	2.373	2.331	2.294	2.262
%12735683.00	2.370	2.338	2.306	2.275	2.247	2.223
%12736783.00	2.281	2.260	2.238	2.217	2.198	2.182
%12737883.00	2.197	2.185	2.172	2.159	2.147	2.138
%12738983.00	2.117	2.112	2.107	2.101	2.096	2.093
%12740083.00	2.041	2.043	2.043	2.043	2.044	2.047
%12741183.00	1.969	1.976	1.982	1.987	1.993	2.000
%12742283.00	1.901	1.912	1.922	1.931	1.942	1.953
%12743383.00	1.836	1.850	1.864	1.877	1.891	1.906
%12744483.00	1.774	1.791	1.807	1.824	1.841	1.858
%12745583.00	1.715	1.734	1.753	1.771	1.791	1.811
%12746683.00	1.658	1.679	1.699	1.720	1.742	1.764
%12747783.00	1.603	1.625	1.647	1.670	1.693	1.717
%12748883.00	1.550	1.573	1.597	1.620	1.645	1.671
%12749983.00	1.498	1.523	1.547	1.572	1.598	1.624
%12751083.00	1.449	1.474	1.499	1.524	1.551	1.578
%12752183.00	1.400	1.426	1.451	1.477	1.504	1.532
%12753283.00	1.354	1.379	1.405	1.431	1.459	1.487
%12754383.00	1.308	1.334	1.360	1.386	1.413	1.442
%12755483.00	1.264	1.289	1.315	1.342	1.369	1.397
%12756583.00	1.220	1.246	1.272	1.298	1.325	1.353
%12757683.00	1.178	1.203	1.229	1.255	1.282	1.310
%12758783.00	1.137	1.162	1.187	1.213	1.240	1.267
%12759883.00	1.097	1.121	1.146	1.172	1.198	1.224
%12760983.00	1.058	1.082	1.106	1.131	1.157	1.183
%12762083.00	1.020	1.043	1.067	1.091	1.116	1.142
%12763183.00	0.982	1.005	1.029	1.052	1.077	1.102
%12764283.00	0.946	0.968	0.991	1.014	1.038	1.062
%12765383.00	0.911	0.932	0.955	0.977	1.000	1.024

Y [ft]	655909	657009	658109	659209	660309	661409
%12766483.00	0.876	0.897	0.919	0.941	0.963	0.986
%12767583.00	0.843	0.863	0.884	0.905	0.927	0.949
%12768683.00	0.810	0.830	0.850	0.871	0.891	0.913
%12769783.00	0.778	0.797	0.817	0.837	0.857	0.877
%12770883.00	0.747	0.766	0.785	0.804	0.823	0.843
%12771983.00	0.717	0.735	0.753	0.772	0.791	0.810
%12773083.00	0.688	0.705	0.723	0.741	0.759	0.777
%12774183.00	0.660	0.676	0.693	0.710	0.728	0.745
%12775283.00	0.633	0.648	0.664	0.681	0.697	0.714

Y [ft]	662509	663609	664709	665809	666909	668009
%12686183.00	0.490	0.490	0.489	0.489	0.488	0.486
%12687283.00	0.517	0.516	0.516	0.515	0.514	0.512
%12688383.00	0.544	0.544	0.543	0.542	0.541	0.539
%12689483.00	0.574	0.573	0.572	0.571	0.570	0.568
%12690583.00	0.604	0.603	0.602	0.601	0.599	0.597
%12691683.00	0.636	0.635	0.634	0.632	0.630	0.628
%12692783.00	0.669	0.668	0.667	0.665	0.663	0.660
%12693883.00	0.703	0.702	0.701	0.699	0.697	0.694
%12694983.00	0.739	0.738	0.736	0.734	0.732	0.729
%12696083.00	0.777	0.775	0.773	0.771	0.768	0.765
%12697183.00	0.816	0.814	0.812	0.809	0.806	0.803
%12698283.00	0.857	0.855	0.852	0.849	0.845	0.841
%12699383.00	0.900	0.897	0.894	0.890	0.886	0.882
%12700483.00	0.944	0.941	0.937	0.933	0.929	0.924
%12701583.00	0.990	0.986	0.982	0.977	0.972	0.967
%12702683.00	1.038	1.034	1.029	1.023	1.018	1.012
%12703783.00	1.088	1.083	1.077	1.071	1.064	1.058
%12704883.00	1.139	1.133	1.127	1.120	1.113	1.105
%12705983.00	1.193	1.186	1.178	1.170	1.162	1.154
%12707083.00	1.248	1.240	1.231	1.222	1.213	1.204
%12708183.00	1.305	1.296	1.286	1.276	1.266	1.256
%12709283.00	1.364	1.353	1.342	1.330	1.319	1.308
%12710383.00	1.425	1.412	1.399	1.386	1.374	1.362
%12711483.00	1.488	1.473	1.458	1.443	1.429	1.416
%12712583.00	1.552	1.534	1.518	1.501	1.486	1.471
%12713683.00	1.617	1.597	1.578	1.560	1.543	1.527
%12714783.00	1.683	1.661	1.639	1.619	1.600	1.582
%12715883.00	1.750	1.724	1.700	1.677	1.657	1.638
%12716983.00	1.818	1.788	1.761	1.736	1.713	1.693
%12718083.00	1.884	1.851	1.821	1.793	1.769	1.747
%12719183.00	1.950	1.913	1.879	1.849	1.823	1.800

Y [ft]	<- X [ft] ->					
	662509	663609	664709	665809	666909	668009
%12720283.00	2.013	1.972	1.935	1.903	1.876	1.852
%12721383.00	2.073	2.028	1.989	1.955	1.925	1.901
%12722483.00	2.129	2.080	2.038	2.003	1.973	1.947
%12723583.00	2.179	2.128	2.084	2.047	2.016	1.991
%12724683.00	2.222	2.169	2.124	2.086	2.055	2.031
%12725783.00	2.258	2.203	2.158	2.120	2.090	2.067
%12726883.00	2.284	2.230	2.186	2.149	2.121	2.099
%12727983.00	2.302	2.249	2.207	2.172	2.146	2.126
%12729083.00	2.310	2.261	2.221	2.189	2.165	2.148
%12730183.00	2.309	2.264	2.228	2.200	2.180	2.166
%12731283.00	2.301	2.261	2.230	2.206	2.189	2.179
%12732383.00	2.285	2.251	2.225	2.206	2.194	2.188
%12733483.00	2.263	2.235	2.215	2.201	2.193	2.192
%12734583.00	2.235	2.215	2.200	2.191	2.188	2.191
%12735683.00	2.204	2.189	2.180	2.177	2.179	2.186
%12736783.00	2.169	2.161	2.157	2.159	2.165	2.177
%12737883.00	2.132	2.129	2.131	2.137	2.148	2.164
%12738983.00	2.092	2.095	2.102	2.112	2.128	2.148
%12740083.00	2.051	2.059	2.070	2.085	2.104	2.128
%12741183.00	2.009	2.021	2.036	2.054	2.077	2.104
%12742283.00	1.966	1.982	2.000	2.022	2.048	2.077
%12743383.00	1.922	1.941	1.963	1.987	2.016	2.048
%12744483.00	1.878	1.900	1.924	1.951	1.981	2.015
%12745583.00	1.833	1.857	1.883	1.912	1.945	1.980
%12746683.00	1.788	1.814	1.842	1.873	1.906	1.943
%12747783.00	1.743	1.770	1.800	1.832	1.866	1.904
%12748883.00	1.697	1.726	1.756	1.789	1.825	1.863
%12749983.00	1.652	1.681	1.713	1.746	1.782	1.821
%12751083.00	1.606	1.637	1.668	1.702	1.738	1.777
%12752183.00	1.561	1.592	1.624	1.657	1.694	1.732
%12753283.00	1.516	1.546	1.579	1.612	1.648	1.686
%12754383.00	1.471	1.502	1.534	1.567	1.602	1.640
%12755483.00	1.426	1.457	1.488	1.521	1.556	1.593
%12756583.00	1.382	1.412	1.443	1.476	1.510	1.546
%12757683.00	1.338	1.368	1.399	1.430	1.464	1.498
%12758783.00	1.295	1.324	1.354	1.385	1.418	1.451
%12759883.00	1.252	1.280	1.310	1.340	1.372	1.404
%12760983.00	1.210	1.238	1.266	1.296	1.326	1.358
%12762083.00	1.168	1.195	1.223	1.252	1.281	1.312
%12763183.00	1.127	1.154	1.181	1.208	1.237	1.266

Y [ft]	<- X [ft] ->					
	662509	663609	664709	665809	666909	668009
%12764283.00	1.087	1.113	1.139	1.166	1.193	1.221
%12765383.00	1.048	1.072	1.098	1.124	1.150	1.177
%12766483.00	1.009	1.033	1.057	1.082	1.108	1.134
%12767583.00	0.971	0.994	1.018	1.042	1.066	1.091
%12768683.00	0.934	0.957	0.979	1.002	1.026	1.050
%12769783.00	0.898	0.920	0.942	0.964	0.986	1.009
%12770883.00	0.863	0.884	0.905	0.926	0.947	0.969
%12771983.00	0.829	0.849	0.869	0.889	0.910	0.931
%12773083.00	0.795	0.814	0.834	0.853	0.873	0.893
%12774183.00	0.763	0.781	0.799	0.818	0.837	0.856
%12775283.00	0.731	0.749	0.766	0.784	0.802	0.820

Y [ft]	<- X [ft] ->					
	669109	670209	671309	672409	673509	674609
%12686183.00	0.485	0.483	0.481	0.478	0.476	0.473
%12687283.00	0.510	0.509	0.506	0.504	0.501	0.499
%12688383.00	0.538	0.535	0.533	0.531	0.528	0.525
%12689483.00	0.566	0.564	0.561	0.558	0.555	0.552
%12690583.00	0.595	0.593	0.590	0.587	0.584	0.581
%12691683.00	0.626	0.623	0.620	0.617	0.614	0.610
%12692783.00	0.658	0.655	0.652	0.648	0.645	0.641
%12693883.00	0.691	0.688	0.685	0.681	0.677	0.673
%12694983.00	0.726	0.722	0.718	0.715	0.711	0.706
%12696083.00	0.761	0.758	0.754	0.750	0.745	0.741
%12697183.00	0.799	0.795	0.790	0.786	0.781	0.777
%12698283.00	0.837	0.833	0.828	0.824	0.819	0.814
%12699383.00	0.877	0.873	0.868	0.863	0.857	0.852
%12700483.00	0.919	0.914	0.908	0.903	0.897	0.892
%12701583.00	0.962	0.956	0.950	0.944	0.938	0.933
%12702683.00	1.006	1.000	0.993	0.987	0.981	0.975
%12703783.00	1.051	1.045	1.038	1.031	1.025	1.018
%12704883.00	1.098	1.091	1.084	1.077	1.070	1.063
%12705983.00	1.146	1.138	1.131	1.123	1.116	1.109
%12707083.00	1.196	1.187	1.179	1.171	1.163	1.156
%12708183.00	1.246	1.237	1.228	1.220	1.211	1.204
%12709283.00	1.298	1.288	1.278	1.269	1.261	1.253
%12710383.00	1.350	1.340	1.329	1.320	1.311	1.303
%12711483.00	1.404	1.392	1.381	1.371	1.362	1.354
%12712583.00	1.458	1.445	1.434	1.423	1.414	1.406
%12713683.00	1.512	1.499	1.487	1.476	1.467	1.458
%12714783.00	1.567	1.553	1.540	1.529	1.519	1.511
%12715883.00	1.621	1.606	1.593	1.582	1.573	1.564
%12716983.00	1.675	1.660	1.647	1.635	1.626	1.618

Y [ft]	<- X [ft] ->					
	669109	670209	671309	672409	673509	674609
%12718083.00	1.729	1.713	1.699	1.688	1.679	1.672
%12719183.00	1.781	1.765	1.751	1.740	1.732	1.725
%12720283.00	1.832	1.815	1.802	1.791	1.784	1.779
%12721383.00	1.881	1.864	1.851	1.842	1.835	1.831
%12722483.00	1.927	1.911	1.899	1.891	1.886	1.884
%12723583.00	1.971	1.956	1.945	1.938	1.935	1.935
%12724683.00	2.012	1.998	1.989	1.984	1.982	1.985
%12725783.00	2.049	2.037	2.030	2.027	2.028	2.033
%12726883.00	2.083	2.073	2.068	2.068	2.072	2.080
%12727983.00	2.112	2.105	2.103	2.106	2.113	2.125
%12729083.00	2.138	2.133	2.135	2.141	2.152	2.168
%12730183.00	2.159	2.158	2.163	2.173	2.188	2.209
%12731283.00	2.176	2.179	2.187	2.201	2.221	2.246
%12732383.00	2.188	2.195	2.208	2.226	2.250	2.280
%12733483.00	2.196	2.207	2.224	2.247	2.276	2.311
%12734583.00	2.200	2.215	2.237	2.264	2.297	2.337
%12735683.00	2.200	2.219	2.245	2.276	2.314	2.359
%12736783.00	2.195	2.218	2.248	2.284	2.326	2.376
%12737883.00	2.186	2.213	2.247	2.287	2.333	2.387
%12738983.00	2.173	2.204	2.241	2.285	2.335	2.393
%12740083.00	2.156	2.191	2.231	2.278	2.331	2.392
%12741183.00	2.136	2.173	2.216	2.265	2.321	2.385
%12742283.00	2.112	2.152	2.197	2.248	2.306	2.372
%12743383.00	2.084	2.126	2.173	2.226	2.285	2.352
%12744483.00	2.054	2.097	2.145	2.199	2.259	2.326
%12745583.00	2.020	2.065	2.114	2.168	2.228	2.295
%12746683.00	1.984	2.029	2.079	2.133	2.193	2.258
%12747783.00	1.946	1.991	2.040	2.094	2.153	2.217
%12748883.00	1.905	1.950	1.999	2.052	2.110	2.172
%12749983.00	1.862	1.907	1.955	2.008	2.064	2.124
%12751083.00	1.818	1.862	1.910	1.961	2.015	2.073
%12752183.00	1.773	1.816	1.862	1.912	1.964	2.020
%12753283.00	1.726	1.769	1.814	1.861	1.912	1.965
%12754383.00	1.679	1.720	1.764	1.810	1.859	1.910
%12755483.00	1.631	1.671	1.714	1.758	1.804	1.853
%12756583.00	1.583	1.622	1.663	1.705	1.750	1.796
%12757683.00	1.535	1.572	1.612	1.652	1.695	1.739
%12758783.00	1.486	1.523	1.560	1.600	1.640	1.682
%12759883.00	1.438	1.473	1.510	1.547	1.586	1.626
%12760983.00	1.390	1.424	1.459	1.495	1.532	1.569

<- X [ft] ->

Y [ft]	669109	670209	671309	672409	673509	674609
%12762083.00	1.343	1.376	1.409	1.443	1.478	1.514
%12763183.00	1.297	1.328	1.359	1.392	1.425	1.460
%12764283.00	1.250	1.280	1.311	1.342	1.374	1.406
%12765383.00	1.205	1.234	1.263	1.292	1.323	1.353
%12766483.00	1.161	1.188	1.216	1.244	1.273	1.302
%12767583.00	1.117	1.143	1.169	1.196	1.224	1.251
%12768683.00	1.074	1.099	1.124	1.150	1.176	1.202
%12769783.00	1.032	1.056	1.080	1.105	1.129	1.154
%12770883.00	0.992	1.014	1.037	1.060	1.084	1.107
%12771983.00	0.952	0.973	0.995	1.017	1.039	1.062
%12773083.00	0.913	0.934	0.954	0.975	0.996	1.018
%12774183.00	0.875	0.895	0.915	0.935	0.954	0.975
%12775283.00	0.839	0.857	0.876	0.895	0.914	0.933

<- X [ft] ->

Y [ft]	675709	676809	677909	679009	680109	681209
%12686183.00	0.471	0.468	0.465	0.461	0.458	0.454
%12687283.00	0.496	0.493	0.489	0.486	0.482	0.479
%12688383.00	0.522	0.518	0.515	0.511	0.508	0.504
%12689483.00	0.549	0.545	0.542	0.538	0.534	0.530
%12690583.00	0.577	0.574	0.570	0.566	0.562	0.557
%12691683.00	0.607	0.603	0.599	0.595	0.590	0.586
%12692783.00	0.637	0.633	0.629	0.625	0.620	0.616
%12693883.00	0.669	0.665	0.660	0.656	0.651	0.646
%12694983.00	0.702	0.698	0.693	0.688	0.683	0.678
%12696083.00	0.736	0.732	0.727	0.722	0.717	0.712
%12697183.00	0.772	0.767	0.762	0.757	0.751	0.746
%12698283.00	0.809	0.803	0.798	0.793	0.787	0.782
%12699383.00	0.847	0.841	0.836	0.830	0.825	0.819
%12700483.00	0.886	0.880	0.875	0.869	0.863	0.857
%12701583.00	0.927	0.921	0.915	0.909	0.903	0.897
%12702683.00	0.968	0.962	0.956	0.950	0.944	0.938
%12703783.00	1.012	1.005	0.999	0.993	0.986	0.980
%12704883.00	1.056	1.049	1.043	1.037	1.030	1.024
%12705983.00	1.102	1.095	1.088	1.082	1.075	1.069
%12707083.00	1.148	1.141	1.135	1.128	1.122	1.115
%12708183.00	1.196	1.189	1.182	1.176	1.170	1.163
%12709283.00	1.245	1.238	1.231	1.225	1.219	1.213
%12710383.00	1.295	1.288	1.281	1.275	1.269	1.263
%12711483.00	1.346	1.339	1.333	1.327	1.321	1.315
%12712583.00	1.398	1.391	1.385	1.379	1.374	1.369
%12713683.00	1.451	1.444	1.438	1.433	1.428	1.423
%12714783.00	1.504	1.498	1.492	1.488	1.484	1.480

Y [ft]	<- X [ft] ->					
	675709	676809	677909	679009	680109	681209
%12715883.00	1.558	1.552	1.547	1.544	1.540	1.537
%12716983.00	1.612	1.607	1.603	1.600	1.598	1.596
%12718083.00	1.666	1.662	1.660	1.658	1.657	1.657
%12719183.00	1.721	1.718	1.717	1.717	1.717	1.719
%12720283.00	1.776	1.774	1.775	1.776	1.779	1.782
%12721383.00	1.830	1.831	1.833	1.836	1.841	1.846
%12722483.00	1.884	1.887	1.891	1.897	1.905	1.912
%12723583.00	1.937	1.943	1.950	1.959	1.969	1.980
%12724683.00	1.990	1.998	2.009	2.021	2.034	2.049
%12725783.00	2.042	2.053	2.067	2.083	2.101	2.119
%12726883.00	2.092	2.107	2.125	2.146	2.168	2.191
%12727983.00	2.141	2.161	2.183	2.208	2.236	2.264
%12729083.00	2.188	2.212	2.240	2.271	2.304	2.338
%12730183.00	2.233	2.263	2.296	2.332	2.372	2.413
%12731283.00	2.276	2.311	2.350	2.393	2.439	2.489
%12732383.00	2.315	2.356	2.401	2.452	2.506	2.564
%12733483.00	2.351	2.398	2.450	2.508	2.571	2.639
%12734583.00	2.383	2.436	2.495	2.561	2.633	2.711
%12735683.00	2.411	2.469	2.535	2.609	2.690	2.780
%12736783.00	2.433	2.497	2.570	2.651	2.742	2.842
%12737883.00	2.449	2.519	2.597	2.686	2.785	2.896
%12738983.00	2.458	2.533	2.617	2.712	2.819	2.939
%12740083.00	2.461	2.539	2.628	2.727	2.840	2.968
%12741183.00	2.457	2.538	2.629	2.732	2.848	2.981
%12742283.00	2.445	2.527	2.620	2.724	2.842	2.976
%12743383.00	2.426	2.509	2.602	2.706	2.822	2.954
%12744483.00	2.400	2.483	2.574	2.676	2.789	2.916
%12745583.00	2.368	2.449	2.538	2.637	2.745	2.865
%12746683.00	2.330	2.409	2.495	2.589	2.692	2.803
%12747783.00	2.287	2.363	2.445	2.535	2.631	2.734
%12748883.00	2.240	2.312	2.391	2.475	2.565	2.660
%12749983.00	2.189	2.258	2.332	2.411	2.495	2.582
%12751083.00	2.135	2.201	2.271	2.345	2.422	2.502
%12752183.00	2.079	2.142	2.207	2.276	2.348	2.422
%12753283.00	2.022	2.081	2.143	2.207	2.273	2.342
%12754383.00	1.963	2.019	2.077	2.137	2.199	2.262
%12755483.00	1.904	1.957	2.011	2.067	2.125	2.183
%12756583.00	1.844	1.894	1.945	1.998	2.051	2.106
%12757683.00	1.785	1.832	1.880	1.929	1.979	2.030
%12758783.00	1.725	1.770	1.815	1.861	1.908	1.955

Y [ft]	675709	676809	677909	679009	680109	681209
%12759883.00	1.666	1.708	1.751	1.794	1.838	1.882
%12760983.00	1.608	1.648	1.688	1.729	1.770	1.811
%12762083.00	1.551	1.588	1.626	1.664	1.703	1.741
%12763183.00	1.494	1.530	1.565	1.601	1.638	1.674
%12764283.00	1.439	1.472	1.506	1.540	1.574	1.608
%12765383.00	1.384	1.416	1.448	1.480	1.512	1.543
%12766483.00	1.331	1.361	1.391	1.421	1.451	1.481
%12767583.00	1.279	1.307	1.336	1.364	1.392	1.420
%12768683.00	1.229	1.255	1.282	1.308	1.335	1.361
%12769783.00	1.179	1.204	1.229	1.255	1.280	1.304
%12770883.00	1.131	1.155	1.178	1.202	1.226	1.249
%12771983.00	1.084	1.107	1.129	1.151	1.173	1.195
%12773083.00	1.039	1.060	1.081	1.102	1.123	1.143
%12774183.00	0.995	1.015	1.035	1.054	1.074	1.093
%12775283.00	0.952	0.971	0.990	1.008	1.027	1.045

<- X [ft] ->

Y [ft]	682309	683409	684509	685609	686709	687809
%12686183.00	0.451	0.447	0.443	0.439	0.435	0.431
%12687283.00	0.475	0.471	0.467	0.463	0.458	0.454
%12688383.00	0.500	0.496	0.491	0.487	0.482	0.478
%12689483.00	0.526	0.522	0.517	0.513	0.508	0.503
%12690583.00	0.553	0.548	0.544	0.539	0.534	0.529
%12691683.00	0.581	0.577	0.572	0.567	0.562	0.556
%12692783.00	0.611	0.606	0.601	0.596	0.590	0.585
%12693883.00	0.641	0.636	0.631	0.626	0.620	0.614
%12694983.00	0.673	0.668	0.662	0.657	0.651	0.645
%12696083.00	0.706	0.701	0.695	0.689	0.683	0.677
%12697183.00	0.740	0.735	0.729	0.723	0.717	0.711
%12698283.00	0.776	0.770	0.764	0.758	0.752	0.745
%12699383.00	0.813	0.807	0.801	0.795	0.788	0.782
%12700483.00	0.851	0.845	0.839	0.832	0.826	0.819
%12701583.00	0.891	0.884	0.878	0.872	0.865	0.858
%12702683.00	0.932	0.925	0.919	0.912	0.905	0.898
%12703783.00	0.974	0.967	0.961	0.954	0.947	0.940
%12704883.00	1.018	1.011	1.004	0.998	0.991	0.984
%12705983.00	1.063	1.056	1.050	1.043	1.036	1.029
%12707083.00	1.109	1.103	1.096	1.090	1.083	1.075
%12708183.00	1.157	1.151	1.144	1.138	1.131	1.124
%12709283.00	1.207	1.200	1.194	1.188	1.181	1.174
%12710383.00	1.257	1.252	1.246	1.240	1.233	1.226
%12711483.00	1.310	1.304	1.299	1.293	1.287	1.280
%12712583.00	1.364	1.359	1.354	1.348	1.342	1.336

Y [ft]	<- X [ft] ->					
	682309	683409	684509	685609	686709	687809
%12713683.00	1.419	1.415	1.410	1.405	1.400	1.394
%12714783.00	1.476	1.472	1.469	1.464	1.460	1.455
%12715883.00	1.535	1.532	1.529	1.526	1.522	1.517
%12716983.00	1.595	1.593	1.591	1.589	1.586	1.582
%12718083.00	1.656	1.656	1.656	1.655	1.653	1.650
%12719183.00	1.720	1.721	1.722	1.722	1.722	1.720
%12720283.00	1.785	1.788	1.791	1.793	1.794	1.794
%12721383.00	1.852	1.857	1.862	1.866	1.869	1.870
%12722483.00	1.921	1.929	1.936	1.942	1.947	1.950
%12723583.00	1.991	2.002	2.012	2.021	2.029	2.034
%12724683.00	2.064	2.078	2.092	2.104	2.114	2.122
%12725783.00	2.138	2.157	2.174	2.190	2.204	2.215
%12726883.00	2.215	2.238	2.260	2.281	2.298	2.313
%12727983.00	2.293	2.322	2.350	2.376	2.398	2.416
%12729083.00	2.374	2.409	2.443	2.475	2.504	2.527
%12730183.00	2.456	2.499	2.541	2.580	2.616	2.645
%12731283.00	2.540	2.592	2.643	2.692	2.735	2.772
%12732383.00	2.625	2.687	2.749	2.809	2.864	2.910
%12733483.00	2.711	2.785	2.860	2.933	3.002	3.061
%12734583.00	2.795	2.883	2.974	3.065	3.151	3.227
%12735683.00	2.877	2.981	3.090	3.202	3.312	3.411
%12736783.00	2.953	3.074	3.205	3.344	3.484	3.617
%12737883.00	3.021	3.160	3.314	3.484	3.666	3.849
%12738983.00	3.076	3.232	3.409	3.613	3.845	4.102
%12740083.00	3.114	3.283	3.480	3.714	3.998	4.349
%12741183.00	3.132	3.309	3.517	3.769	4.085	4.510
%12742283.00	3.128	3.305	3.513	3.763	4.075	4.485
%12743383.00	3.103	3.273	3.470	3.701	3.975	4.300
%12744483.00	3.058	3.217	3.396	3.598	3.823	4.063
%12745583.00	2.997	3.142	3.301	3.473	3.654	3.833
%12746683.00	2.925	3.055	3.195	3.340	3.487	3.626
%12747783.00	2.845	2.962	3.084	3.208	3.329	3.442
%12748883.00	2.760	2.865	2.972	3.079	3.182	3.277
%12749983.00	2.673	2.767	2.862	2.955	3.045	3.127
%12751083.00	2.585	2.670	2.754	2.837	2.916	2.990
%12752183.00	2.498	2.574	2.650	2.725	2.796	2.862
%12753283.00	2.411	2.481	2.550	2.617	2.682	2.743
%12754383.00	2.326	2.390	2.453	2.515	2.574	2.630
%12755483.00	2.242	2.301	2.359	2.416	2.471	2.523
%12756583.00	2.160	2.215	2.268	2.321	2.372	2.420

Y [ft] <- X [ft] ->

Y [ft]	682309	683409	684509	685609	686709	687809
%12757683.00	2.080	2.131	2.180	2.229	2.277	2.322
%12758783.00	2.002	2.049	2.095	2.141	2.185	2.228
%12759883.00	1.926	1.970	2.013	2.055	2.097	2.136
%12760983.00	1.852	1.893	1.933	1.973	2.011	2.048
%12762083.00	1.780	1.818	1.856	1.893	1.928	1.963
%12763183.00	1.710	1.745	1.781	1.815	1.849	1.881
%12764283.00	1.641	1.675	1.708	1.740	1.771	1.802
%12765383.00	1.575	1.606	1.637	1.667	1.697	1.725
%12766483.00	1.511	1.540	1.569	1.597	1.624	1.651
%12767583.00	1.448	1.476	1.503	1.529	1.554	1.579
%12768683.00	1.388	1.413	1.438	1.463	1.487	1.510
%12769783.00	1.329	1.353	1.377	1.399	1.422	1.443
%12770883.00	1.272	1.295	1.317	1.338	1.359	1.379
%12771983.00	1.217	1.238	1.259	1.279	1.298	1.317
%12773083.00	1.164	1.184	1.203	1.222	1.240	1.257
%12774183.00	1.112	1.131	1.149	1.166	1.183	1.200
%12775283.00	1.063	1.080	1.097	1.113	1.129	1.144

Y [ft] <- X [ft] ->

Y [ft]	688909	690009	691109	692209	693309	694409
%12686183.00	0.426	0.422	0.417	0.412	0.408	0.403
%12687283.00	0.449	0.444	0.440	0.435	0.430	0.424
%12688383.00	0.473	0.468	0.463	0.458	0.453	0.447
%12689483.00	0.498	0.493	0.488	0.482	0.477	0.471
%12690583.00	0.524	0.519	0.513	0.507	0.502	0.496
%12691683.00	0.551	0.545	0.540	0.534	0.528	0.522
%12692783.00	0.579	0.573	0.568	0.561	0.555	0.549
%12693883.00	0.609	0.603	0.597	0.590	0.584	0.577
%12694983.00	0.639	0.633	0.627	0.620	0.613	0.606
%12696083.00	0.671	0.665	0.658	0.651	0.644	0.637
%12697183.00	0.704	0.698	0.691	0.684	0.677	0.669
%12698283.00	0.739	0.732	0.725	0.718	0.710	0.702
%12699383.00	0.775	0.768	0.760	0.753	0.745	0.737
%12700483.00	0.812	0.805	0.797	0.790	0.782	0.773
%12701583.00	0.851	0.843	0.836	0.828	0.819	0.811
%12702683.00	0.891	0.883	0.876	0.867	0.859	0.850
%12703783.00	0.933	0.925	0.917	0.909	0.900	0.891
%12704883.00	0.976	0.968	0.960	0.952	0.943	0.933
%12705983.00	1.021	1.013	1.005	0.996	0.987	0.978
%12707083.00	1.068	1.060	1.052	1.043	1.033	1.024
%12708183.00	1.116	1.108	1.100	1.091	1.082	1.072
%12709283.00	1.167	1.159	1.150	1.141	1.132	1.121
%12710383.00	1.219	1.211	1.203	1.194	1.184	1.173

Y [ft]	<- X [ft] ->					
	688909	690009	691109	692209	693309	694409
%12711483.00	1.273	1.265	1.257	1.248	1.238	1.228
%12712583.00	1.329	1.322	1.314	1.305	1.295	1.284
%12713683.00	1.388	1.381	1.373	1.364	1.354	1.343
%12714783.00	1.449	1.442	1.434	1.425	1.415	1.404
%12715883.00	1.512	1.505	1.498	1.489	1.479	1.468
%12716983.00	1.577	1.572	1.564	1.556	1.546	1.535
%12718083.00	1.646	1.641	1.634	1.626	1.616	1.605
%12719183.00	1.717	1.713	1.707	1.699	1.689	1.678
%12720283.00	1.792	1.788	1.783	1.775	1.766	1.754
%12721383.00	1.870	1.867	1.862	1.855	1.846	1.834
%12722483.00	1.951	1.950	1.946	1.940	1.930	1.918
%12723583.00	2.037	2.037	2.034	2.028	2.019	2.007
%12724683.00	2.127	2.129	2.127	2.121	2.112	2.100
%12725783.00	2.222	2.226	2.225	2.220	2.211	2.198
%12726883.00	2.323	2.329	2.329	2.325	2.316	2.302
%12727983.00	2.430	2.438	2.440	2.436	2.427	2.411
%12729083.00	2.544	2.555	2.559	2.555	2.545	2.528
%12730183.00	2.668	2.682	2.687	2.683	2.671	2.652
%12731283.00	2.801	2.819	2.826	2.821	2.807	2.784
%12732383.00	2.946	2.969	2.977	2.972	2.954	2.925
%12733483.00	3.106	3.135	3.145	3.137	3.113	3.076
%12734583.00	3.286	3.323	3.334	3.321	3.286	3.237
%12735683.00	3.490	3.538	3.550	3.527	3.477	3.409
%12736783.00	3.727	3.793	3.804	3.763	3.686	3.591
%12737883.00	4.009	4.109	4.115	4.037	3.913	3.777
%12738983.00	4.356	4.528	4.518	4.358	4.151	3.957
%12740083.00	4.778	5.161	5.088	4.712	4.372	4.110
%12741183.00	5.157	6.430	5.872	4.987	4.514	4.205
%12742283.00	5.071	5.885	5.625	4.945	4.511	4.219
%12743383.00	4.665	4.953	4.924	4.658	4.382	4.157
%12744483.00	4.290	4.443	4.456	4.349	4.196	4.045
%12745583.00	3.989	4.093	4.122	4.082	4.003	3.911
%12746683.00	3.744	3.825	3.862	3.856	3.821	3.772
%12747783.00	3.537	3.607	3.648	3.661	3.654	3.634
%12748883.00	3.358	3.422	3.465	3.490	3.500	3.501
%12749983.00	3.199	3.258	3.303	3.335	3.357	3.372
%12751083.00	3.055	3.111	3.157	3.193	3.222	3.246
%12752183.00	2.923	2.976	3.022	3.061	3.094	3.125
%12753283.00	2.799	2.850	2.895	2.935	2.972	3.006
%12754383.00	2.683	2.731	2.775	2.816	2.853	2.889

Y [ft]	<- X [ft] -> 688909	690009	691109	692209	693309	694409
%12755483.00	2.572	2.618	2.661	2.701	2.739	2.775
%12756583.00	2.467	2.511	2.552	2.591	2.628	2.663
%12757683.00	2.366	2.407	2.447	2.484	2.520	2.554
%12758783.00	2.269	2.308	2.345	2.381	2.415	2.447
%12759883.00	2.175	2.212	2.247	2.281	2.313	2.343
%12760983.00	2.084	2.119	2.152	2.184	2.214	2.243
%12762083.00	1.997	2.030	2.061	2.090	2.118	2.145
%12763183.00	1.913	1.943	1.972	2.000	2.026	2.050
%12764283.00	1.831	1.859	1.886	1.912	1.936	1.959
%12765383.00	1.752	1.779	1.804	1.828	1.850	1.871
%12766483.00	1.676	1.701	1.724	1.746	1.767	1.786
%12767583.00	1.603	1.626	1.647	1.668	1.686	1.704
%12768683.00	1.532	1.553	1.573	1.592	1.609	1.625
%12769783.00	1.464	1.483	1.502	1.519	1.535	1.550
%12770883.00	1.398	1.416	1.433	1.449	1.464	1.477
%12771983.00	1.335	1.352	1.367	1.382	1.396	1.408
%12773083.00	1.274	1.289	1.304	1.318	1.330	1.341
%12774183.00	1.215	1.229	1.243	1.256	1.267	1.277
%12775283.00	1.158	1.172	1.185	1.196	1.207	1.216

Y [ft]	<- X [ft] -> 695509	696609	697709	698809	699909	701009
%12686183.00	0.398	0.392	0.387	0.382	0.376	0.370
%12687283.00	0.419	0.414	0.408	0.402	0.396	0.391
%12688383.00	0.442	0.436	0.430	0.424	0.418	0.412
%12689483.00	0.465	0.459	0.453	0.447	0.440	0.434
%12690583.00	0.490	0.483	0.477	0.470	0.464	0.457
%12691683.00	0.515	0.509	0.502	0.495	0.488	0.481
%12692783.00	0.542	0.535	0.528	0.521	0.514	0.506
%12693883.00	0.570	0.563	0.556	0.548	0.540	0.533
%12694983.00	0.599	0.592	0.584	0.576	0.568	0.560
%12696083.00	0.630	0.622	0.614	0.606	0.597	0.589
%12697183.00	0.661	0.653	0.645	0.636	0.628	0.619
%12698283.00	0.694	0.686	0.677	0.668	0.659	0.650
%12699383.00	0.729	0.720	0.711	0.702	0.692	0.683
%12700483.00	0.765	0.756	0.746	0.737	0.727	0.716
%12701583.00	0.802	0.793	0.783	0.773	0.763	0.752
%12702683.00	0.841	0.831	0.821	0.811	0.800	0.789
%12703783.00	0.881	0.871	0.861	0.850	0.839	0.827
%12704883.00	0.924	0.913	0.903	0.891	0.880	0.867
%12705983.00	0.967	0.957	0.946	0.934	0.922	0.909
%12707083.00	1.013	1.002	0.991	0.979	0.966	0.953
%12708183.00	1.061	1.050	1.038	1.025	1.012	0.998

Y [ft]	<- X [ft] ->					
	695509	696609	697709	698809	699909	701009
%12709283.00	1.110	1.099	1.087	1.074	1.060	1.046
%12710383.00	1.162	1.150	1.138	1.124	1.110	1.095
%12711483.00	1.216	1.204	1.191	1.177	1.162	1.146
%12712583.00	1.272	1.260	1.246	1.232	1.216	1.200
%12713683.00	1.331	1.318	1.304	1.289	1.273	1.256
%12714783.00	1.392	1.378	1.364	1.348	1.332	1.314
%12715883.00	1.456	1.442	1.427	1.411	1.393	1.374
%12716983.00	1.522	1.508	1.492	1.475	1.457	1.438
%12718083.00	1.592	1.577	1.561	1.543	1.524	1.504
%12719183.00	1.664	1.649	1.633	1.614	1.594	1.572
%12720283.00	1.740	1.725	1.707	1.688	1.667	1.644
%12721383.00	1.820	1.804	1.786	1.765	1.743	1.719
%12722483.00	1.904	1.887	1.867	1.846	1.822	1.797
%12723583.00	1.992	1.974	1.953	1.930	1.905	1.878
%12724683.00	2.084	2.065	2.043	2.018	1.992	1.963
%12725783.00	2.181	2.161	2.137	2.111	2.082	2.051
%12726883.00	2.283	2.261	2.235	2.207	2.176	2.142
%12727983.00	2.391	2.367	2.339	2.307	2.274	2.238
%12729083.00	2.505	2.478	2.446	2.412	2.375	2.336
%12730183.00	2.626	2.594	2.559	2.521	2.480	2.438
%12731283.00	2.753	2.717	2.677	2.634	2.589	2.543
%12732383.00	2.888	2.845	2.799	2.750	2.701	2.651
%12733483.00	3.030	2.978	2.924	2.869	2.814	2.760
%12734583.00	3.179	3.116	3.052	2.990	2.929	2.871
%12735683.00	3.334	3.256	3.181	3.110	3.043	2.981
%12736783.00	3.492	3.396	3.308	3.227	3.155	3.089
%12737883.00	3.647	3.530	3.428	3.339	3.262	3.194
%12738983.00	3.791	3.652	3.536	3.440	3.360	3.293
%12740083.00	3.908	3.751	3.627	3.528	3.449	3.385
%12741183.00	3.984	3.820	3.694	3.598	3.524	3.467
%12742283.00	4.008	3.852	3.735	3.648	3.583	3.538
%12743383.00	3.982	3.849	3.749	3.676	3.626	3.596
%12744483.00	3.917	3.814	3.737	3.683	3.651	3.639
%12745583.00	3.826	3.756	3.704	3.671	3.658	3.666
%12746683.00	3.723	3.681	3.653	3.640	3.647	3.674
%12747783.00	3.612	3.595	3.587	3.593	3.616	3.661
%12748883.00	3.499	3.500	3.509	3.530	3.567	3.624
%12749983.00	3.384	3.399	3.421	3.453	3.499	3.564
%12751083.00	3.269	3.294	3.324	3.363	3.414	3.481
%12752183.00	3.154	3.185	3.220	3.262	3.315	3.380

Y [ft] <- X [ft] ->

Y [ft]	695509	696609	697709	698809	699909	701009
%12753283.00	3.039	3.073	3.111	3.154	3.205	3.264
%12754383.00	2.924	2.960	2.998	3.040	3.087	3.140
%12755483.00	2.810	2.846	2.883	2.922	2.965	3.011
%12756583.00	2.698	2.732	2.767	2.804	2.841	2.880
%12757683.00	2.587	2.620	2.652	2.685	2.718	2.750
%12758783.00	2.479	2.509	2.539	2.568	2.596	2.623
%12759883.00	2.373	2.401	2.428	2.454	2.478	2.500
%12760983.00	2.270	2.296	2.320	2.343	2.363	2.381
%12762083.00	2.170	2.193	2.215	2.235	2.252	2.267
%12763183.00	2.073	2.094	2.114	2.131	2.146	2.158
%12764283.00	1.980	1.999	2.016	2.031	2.044	2.054
%12765383.00	1.890	1.907	1.922	1.936	1.946	1.954
%12766483.00	1.803	1.819	1.832	1.844	1.853	1.859
%12767583.00	1.720	1.734	1.746	1.756	1.763	1.768
%12768683.00	1.640	1.652	1.663	1.672	1.678	1.682
%12769783.00	1.563	1.574	1.584	1.591	1.597	1.600
%12770883.00	1.489	1.499	1.508	1.514	1.519	1.521
%12771983.00	1.418	1.428	1.435	1.441	1.445	1.447
%12773083.00	1.351	1.359	1.366	1.371	1.374	1.375
%12774183.00	1.286	1.293	1.299	1.304	1.307	1.307
%12775283.00	1.224	1.231	1.236	1.240	1.242	1.243

Y [ft] <- X [ft] ->

Y [ft]	702109	703209	704309	705409	706509	707609
%12686183.00	0.365	0.359	0.353	0.347	0.341	0.334
%12687283.00	0.384	0.378	0.372	0.366	0.359	0.353
%12688383.00	0.405	0.399	0.392	0.386	0.379	0.372
%12689483.00	0.427	0.420	0.413	0.406	0.399	0.392
%12690583.00	0.450	0.443	0.435	0.428	0.420	0.413
%12691683.00	0.474	0.466	0.458	0.451	0.443	0.435
%12692783.00	0.499	0.491	0.483	0.474	0.466	0.458
%12693883.00	0.524	0.516	0.508	0.499	0.490	0.482
%12694983.00	0.552	0.543	0.534	0.525	0.516	0.507
%12696083.00	0.580	0.571	0.562	0.552	0.542	0.533
%12697183.00	0.609	0.600	0.590	0.580	0.570	0.560
%12698283.00	0.640	0.630	0.620	0.610	0.599	0.588
%12699383.00	0.672	0.662	0.651	0.640	0.629	0.618
%12700483.00	0.706	0.695	0.684	0.672	0.661	0.649
%12701583.00	0.741	0.730	0.718	0.706	0.693	0.681
%12702683.00	0.777	0.765	0.753	0.741	0.728	0.714
%12703783.00	0.815	0.803	0.790	0.777	0.763	0.749
%12704883.00	0.855	0.842	0.828	0.815	0.800	0.786
%12705983.00	0.896	0.883	0.868	0.854	0.839	0.824

Y [ft] <- X [ft] ->

	702109	703209	704309	705409	706509	707609
%12707083.00	0.939	0.925	0.910	0.895	0.879	0.863
%12708183.00	0.984	0.969	0.954	0.938	0.921	0.904
%12709283.00	1.031	1.015	0.999	0.982	0.965	0.947
%12710383.00	1.079	1.063	1.046	1.028	1.010	0.991
%12711483.00	1.130	1.113	1.095	1.076	1.057	1.038
%12712583.00	1.183	1.165	1.146	1.127	1.106	1.086
%12713683.00	1.238	1.219	1.199	1.179	1.158	1.136
%12714783.00	1.295	1.275	1.255	1.233	1.211	1.188
%12715883.00	1.355	1.334	1.312	1.290	1.266	1.242
%12716983.00	1.417	1.395	1.372	1.348	1.324	1.298
%12718083.00	1.482	1.459	1.435	1.410	1.383	1.356
%12719183.00	1.549	1.525	1.500	1.473	1.446	1.417
%12720283.00	1.620	1.594	1.567	1.539	1.510	1.480
%12721383.00	1.693	1.666	1.638	1.608	1.577	1.545
%12722483.00	1.770	1.741	1.711	1.679	1.647	1.613
%12723583.00	1.849	1.819	1.787	1.753	1.719	1.683
%12724683.00	1.932	1.900	1.866	1.830	1.794	1.756
%12725783.00	2.018	1.984	1.947	1.910	1.871	1.832
%12726883.00	2.107	2.071	2.032	1.993	1.952	1.910
%12727983.00	2.200	2.161	2.120	2.078	2.035	1.991
%12729083.00	2.296	2.254	2.211	2.167	2.121	2.074
%12730183.00	2.395	2.350	2.305	2.258	2.210	2.161
%12731283.00	2.497	2.449	2.401	2.352	2.302	2.250
%12732383.00	2.601	2.550	2.500	2.448	2.396	2.343
%12733483.00	2.707	2.654	2.601	2.548	2.494	2.438
%12734583.00	2.814	2.759	2.705	2.650	2.594	2.537
%12735683.00	2.922	2.865	2.810	2.755	2.699	2.640
%12736783.00	3.028	2.972	2.917	2.862	2.806	2.748
%12737883.00	3.133	3.078	3.025	2.973	2.919	2.861
%12738983.00	3.235	3.183	3.135	3.086	3.036	2.981
%12740083.00	3.332	3.287	3.246	3.205	3.160	3.109
%12741183.00	3.423	3.388	3.358	3.328	3.293	3.249
%12742283.00	3.507	3.486	3.472	3.458	3.438	3.404
%12743383.00	3.582	3.580	3.587	3.596	3.597	3.581
%12744483.00	3.645	3.667	3.702	3.742	3.777	3.789
%12745583.00	3.694	3.743	3.811	3.894	3.980	4.041
%12746683.00	3.725	3.801	3.907	4.044	4.205	4.360
%12747783.00	3.731	3.832	3.972	4.166	4.430	4.766
%12748883.00	3.707	3.824	3.988	4.220	4.568	5.158
%12749983.00	3.653	3.774	3.939	4.169	4.504	5.031

Y [ft]	<- X [ft] ->					
	702109	703209	704309	705409	706509	707609
%12751083.00	3.569	3.683	3.831	4.022	4.266	4.547
%12752183.00	3.460	3.560	3.681	3.823	3.978	4.114
%12753283.00	3.335	3.417	3.510	3.609	3.702	3.768
%12754383.00	3.199	3.264	3.333	3.399	3.454	3.484
%12755483.00	3.059	3.110	3.159	3.203	3.234	3.243
%12756583.00	2.919	2.958	2.992	3.020	3.036	3.034
%12757683.00	2.782	2.810	2.834	2.851	2.857	2.848
%12758783.00	2.648	2.669	2.685	2.694	2.694	2.681
%12759883.00	2.520	2.535	2.545	2.549	2.544	2.530
%12760983.00	2.396	2.407	2.413	2.413	2.406	2.390
%12762083.00	2.279	2.287	2.289	2.287	2.277	2.261
%12763183.00	2.167	2.172	2.173	2.168	2.158	2.141
%12764283.00	2.060	2.063	2.062	2.056	2.046	2.030
%12765383.00	1.959	1.960	1.958	1.952	1.941	1.925
%12766483.00	1.863	1.863	1.860	1.853	1.842	1.827
%12767583.00	1.771	1.770	1.766	1.759	1.748	1.734
%12768683.00	1.684	1.682	1.678	1.671	1.660	1.646
%12769783.00	1.601	1.599	1.594	1.587	1.577	1.563
%12770883.00	1.522	1.520	1.515	1.508	1.498	1.485
%12771983.00	1.446	1.444	1.439	1.432	1.423	1.411
%12773083.00	1.375	1.372	1.368	1.361	1.352	1.340
%12774183.00	1.307	1.304	1.299	1.293	1.284	1.273
%12775283.00	1.242	1.239	1.234	1.228	1.220	1.210

Y [ft]	<- X [ft] ->					
	708709	709809	710909	712009	713109	714209
%12686183.00	0.328	0.322	0.315	0.309	0.302	0.296
%12687283.00	0.346	0.339	0.332	0.326	0.319	0.312
%12688383.00	0.365	0.358	0.351	0.343	0.336	0.329
%12689483.00	0.384	0.377	0.369	0.362	0.354	0.346
%12690583.00	0.405	0.397	0.389	0.381	0.373	0.365
%12691683.00	0.427	0.418	0.410	0.401	0.393	0.384
%12692783.00	0.449	0.440	0.431	0.423	0.413	0.404
%12693883.00	0.472	0.463	0.454	0.445	0.435	0.425
%12694983.00	0.497	0.487	0.478	0.468	0.458	0.447
%12696083.00	0.523	0.512	0.502	0.492	0.481	0.470
%12697183.00	0.549	0.539	0.528	0.517	0.506	0.494
%12698283.00	0.577	0.566	0.554	0.543	0.531	0.519
%12699383.00	0.606	0.594	0.582	0.570	0.558	0.545
%12700483.00	0.636	0.624	0.611	0.598	0.585	0.572
%12701583.00	0.668	0.655	0.642	0.628	0.614	0.600
%12702683.00	0.701	0.687	0.673	0.659	0.644	0.630
%12703783.00	0.735	0.721	0.706	0.691	0.676	0.660

Y [ft]	708709	709809	710909	712009	713109	714209
%12704883.00	0.771	0.755	0.740	0.724	0.708	0.692
%12705983.00	0.808	0.792	0.775	0.759	0.742	0.725
%12707083.00	0.846	0.830	0.812	0.795	0.777	0.759
%12708183.00	0.887	0.869	0.851	0.832	0.813	0.794
%12709283.00	0.929	0.910	0.891	0.871	0.851	0.831
%12710383.00	0.972	0.952	0.932	0.912	0.891	0.870
%12711483.00	1.017	0.997	0.975	0.954	0.932	0.909
%12712583.00	1.064	1.042	1.020	0.997	0.974	0.951
%12713683.00	1.113	1.090	1.067	1.042	1.018	0.993
%12714783.00	1.164	1.140	1.115	1.089	1.064	1.037
%12715883.00	1.217	1.191	1.165	1.138	1.111	1.083
%12716983.00	1.272	1.245	1.217	1.189	1.160	1.131
%12718083.00	1.328	1.300	1.271	1.241	1.210	1.180
%12719183.00	1.388	1.357	1.326	1.295	1.263	1.231
%12720283.00	1.449	1.417	1.384	1.351	1.317	1.283
%12721383.00	1.512	1.479	1.444	1.409	1.373	1.337
%12722483.00	1.578	1.543	1.506	1.469	1.431	1.393
%12723583.00	1.647	1.609	1.571	1.531	1.491	1.451
%12724683.00	1.717	1.678	1.637	1.596	1.553	1.511
%12725783.00	1.791	1.749	1.706	1.662	1.618	1.572
%12726883.00	1.867	1.822	1.777	1.731	1.684	1.636
%12727983.00	1.945	1.898	1.851	1.802	1.752	1.702
%12729083.00	2.026	1.977	1.927	1.875	1.823	1.769
%12730183.00	2.110	2.059	2.005	1.951	1.896	1.839
%12731283.00	2.197	2.143	2.087	2.030	1.971	1.911
%12732383.00	2.287	2.230	2.172	2.111	2.049	1.986
%12733483.00	2.381	2.321	2.260	2.196	2.130	2.063
%12734583.00	2.478	2.416	2.352	2.284	2.215	2.143
%12735683.00	2.579	2.515	2.448	2.377	2.303	2.226
%12736783.00	2.686	2.619	2.549	2.473	2.394	2.312
%12737883.00	2.798	2.730	2.656	2.576	2.491	2.402
%12738983.00	2.918	2.848	2.770	2.684	2.593	2.496
%12740083.00	3.048	2.976	2.893	2.801	2.700	2.595
%12741183.00	3.191	3.117	3.029	2.927	2.815	2.697
%12742283.00	3.351	3.276	3.179	3.064	2.937	2.804
%12743383.00	3.537	3.459	3.349	3.215	3.067	2.913
%12744483.00	3.759	3.676	3.544	3.381	3.203	3.023
%12745583.00	4.039	3.946	3.774	3.562	3.341	3.129
%12746683.00	4.421	4.301	4.043	3.750	3.472	3.221
%12747783.00	5.021	4.803	4.338	3.919	3.574	3.287

<- X [ft] ->

Y [ft]	<- X [ft] ->					
	708709	709809	710909	712009	713109	714209
%12748883.00	6.381	5.449	4.552	4.012	3.622	3.314
%12749983.00	5.763	5.238	4.484	3.973	3.594	3.291
%12751083.00	4.724	4.560	4.186	3.814	3.495	3.223
%12752183.00	4.164	4.068	3.855	3.601	3.350	3.118
%12753283.00	3.775	3.703	3.561	3.379	3.185	2.993
%12754383.00	3.473	3.413	3.307	3.170	3.017	2.859
%12755483.00	3.224	3.171	3.087	2.979	2.855	2.723
%12756583.00	3.010	2.963	2.893	2.804	2.701	2.590
%12757683.00	2.823	2.780	2.720	2.644	2.558	2.463
%12758783.00	2.656	2.616	2.563	2.498	2.423	2.341
%12759883.00	2.504	2.468	2.420	2.363	2.298	2.226
%12760983.00	2.365	2.332	2.289	2.238	2.180	2.116
%12762083.00	2.238	2.206	2.167	2.122	2.070	2.013
%12763183.00	2.119	2.090	2.054	2.013	1.966	1.915
%12764283.00	2.008	1.981	1.948	1.911	1.869	1.822
%12765383.00	1.904	1.879	1.849	1.815	1.776	1.734
%12766483.00	1.807	1.784	1.756	1.724	1.689	1.651
%12767583.00	1.715	1.693	1.668	1.639	1.606	1.571
%12768683.00	1.629	1.608	1.585	1.558	1.528	1.496
%12769783.00	1.547	1.528	1.506	1.481	1.454	1.424
%12770883.00	1.470	1.452	1.431	1.408	1.383	1.355
%12771983.00	1.396	1.380	1.360	1.339	1.316	1.290
%12773083.00	1.327	1.311	1.293	1.273	1.252	1.228
%12774183.00	1.261	1.246	1.229	1.211	1.191	1.169
%12775283.00	1.198	1.184	1.168	1.151	1.132	1.112

Y [ft]	<- X [ft] ->					
	715309	716409	717509	718609	719709	720809
%12686183.00	0.289	0.282	0.276	0.269	0.262	0.255
%12687283.00	0.305	0.298	0.291	0.284	0.276	0.269
%12688383.00	0.321	0.314	0.306	0.299	0.291	0.284
%12689483.00	0.339	0.331	0.323	0.315	0.307	0.299
%12690583.00	0.357	0.348	0.340	0.332	0.323	0.315
%12691683.00	0.375	0.367	0.358	0.349	0.340	0.332
%12692783.00	0.395	0.386	0.377	0.367	0.358	0.349
%12693883.00	0.416	0.406	0.396	0.386	0.377	0.367
%12694983.00	0.437	0.427	0.417	0.406	0.396	0.386
%12696083.00	0.460	0.449	0.438	0.427	0.416	0.405
%12697183.00	0.483	0.472	0.460	0.448	0.437	0.425
%12698283.00	0.507	0.495	0.483	0.471	0.459	0.447
%12699383.00	0.533	0.520	0.507	0.494	0.481	0.469
%12700483.00	0.559	0.546	0.532	0.519	0.505	0.491
%12701583.00	0.586	0.572	0.558	0.544	0.529	0.515

Y [ft] <- X [ft] ->

Y [ft]	715309	716409	717509	718609	719709	720809
%12702683.00	0.615	0.600	0.585	0.570	0.555	0.540
%12703783.00	0.645	0.629	0.613	0.597	0.581	0.565
%12704883.00	0.675	0.659	0.642	0.626	0.609	0.592
%12705983.00	0.707	0.690	0.672	0.655	0.637	0.619
%12707083.00	0.741	0.722	0.704	0.685	0.667	0.648
%12708183.00	0.775	0.756	0.736	0.717	0.697	0.677
%12709283.00	0.811	0.791	0.770	0.749	0.729	0.708
%12710383.00	0.848	0.827	0.805	0.783	0.761	0.740
%12711483.00	0.887	0.864	0.841	0.818	0.795	0.772
%12712583.00	0.927	0.903	0.879	0.854	0.830	0.806
%12713683.00	0.968	0.943	0.917	0.892	0.866	0.841
%12714783.00	1.011	0.984	0.957	0.931	0.904	0.876
%12715883.00	1.055	1.027	0.999	0.970	0.942	0.913
%12716983.00	1.101	1.072	1.042	1.012	0.982	0.952
%12718083.00	1.149	1.117	1.086	1.054	1.022	0.991
%12719183.00	1.198	1.165	1.131	1.098	1.064	1.031
%12720283.00	1.248	1.213	1.178	1.143	1.108	1.072
%12721383.00	1.301	1.264	1.227	1.189	1.152	1.115
%12722483.00	1.355	1.316	1.276	1.237	1.198	1.159
%12723583.00	1.410	1.369	1.328	1.286	1.245	1.203
%12724683.00	1.468	1.424	1.380	1.337	1.293	1.249
%12725783.00	1.527	1.481	1.435	1.388	1.342	1.296
%12726883.00	1.588	1.539	1.490	1.441	1.392	1.344
%12727983.00	1.651	1.599	1.547	1.496	1.444	1.392
%12729083.00	1.715	1.661	1.606	1.551	1.496	1.442
%12730183.00	1.782	1.724	1.666	1.608	1.550	1.493
%12731283.00	1.851	1.789	1.728	1.666	1.605	1.544
%12732383.00	1.922	1.856	1.791	1.726	1.660	1.596
%12733483.00	1.995	1.925	1.856	1.786	1.717	1.648
%12734583.00	2.070	1.996	1.922	1.848	1.774	1.701
%12735683.00	2.148	2.069	1.989	1.910	1.831	1.754
%12736783.00	2.229	2.143	2.058	1.973	1.889	1.807
%12737883.00	2.312	2.220	2.128	2.036	1.947	1.859
%12738983.00	2.398	2.298	2.198	2.100	2.004	1.910
%12740083.00	2.486	2.377	2.269	2.162	2.059	1.960
%12741183.00	2.577	2.457	2.339	2.224	2.113	2.007
%12742283.00	2.669	2.536	2.407	2.282	2.163	2.050
%12743383.00	2.761	2.613	2.471	2.337	2.210	2.090
%12744483.00	2.850	2.685	2.530	2.385	2.250	2.124
%12745583.00	2.931	2.748	2.580	2.425	2.283	2.151

Y [ft]	715309	716409	717509	718609	719709	720809
%12746683.00	2.997	2.798	2.618	2.455	2.306	2.170
%12747783.00	3.042	2.829	2.641	2.472	2.319	2.180
%12748883.00	3.058	2.838	2.646	2.475	2.320	2.180
%12749983.00	3.039	2.822	2.632	2.462	2.309	2.170
%12751083.00	2.988	2.782	2.599	2.435	2.286	2.149
%12752183.00	2.909	2.720	2.549	2.394	2.251	2.120
%12753283.00	2.812	2.643	2.486	2.341	2.206	2.081
%12754383.00	2.703	2.554	2.412	2.279	2.154	2.036
%12755483.00	2.590	2.459	2.332	2.210	2.094	1.985
%12756583.00	2.476	2.360	2.247	2.137	2.031	1.929
%12757683.00	2.363	2.262	2.161	2.061	1.964	1.870
%12758783.00	2.254	2.164	2.074	1.984	1.895	1.809
%12759883.00	2.149	2.069	1.988	1.907	1.826	1.746
%12760983.00	2.048	1.977	1.904	1.830	1.756	1.683
%12762083.00	1.952	1.888	1.822	1.755	1.688	1.620
%12763183.00	1.860	1.802	1.743	1.682	1.620	1.558
%12764283.00	1.773	1.720	1.666	1.610	1.554	1.497
%12765383.00	1.689	1.642	1.592	1.541	1.489	1.437
%12766483.00	1.610	1.566	1.521	1.474	1.426	1.378
%12767583.00	1.534	1.494	1.452	1.409	1.365	1.320
%12768683.00	1.461	1.425	1.386	1.347	1.306	1.265
%12769783.00	1.392	1.358	1.323	1.286	1.249	1.211
%12770883.00	1.326	1.295	1.262	1.229	1.194	1.158
%12771983.00	1.263	1.234	1.204	1.173	1.141	1.108
%12773083.00	1.203	1.176	1.148	1.119	1.089	1.059
%12774183.00	1.145	1.121	1.095	1.068	1.040	1.012
%12775283.00	1.090	1.067	1.043	1.018	0.993	0.966

<- X [ft] ->

Y [ft]	721909	723009	724109	725209	726309	727409
%12686183.00	0.249	0.242	0.235	0.229	0.222	0.216
%12687283.00	0.262	0.255	0.248	0.241	0.234	0.227
%12688383.00	0.276	0.269	0.262	0.254	0.247	0.239
%12689483.00	0.291	0.283	0.275	0.268	0.260	0.252
%12690583.00	0.307	0.298	0.290	0.282	0.273	0.265
%12691683.00	0.323	0.314	0.305	0.296	0.288	0.279
%12692783.00	0.339	0.330	0.321	0.312	0.302	0.293
%12693883.00	0.357	0.347	0.337	0.328	0.318	0.308
%12694983.00	0.375	0.365	0.354	0.344	0.334	0.324
%12696083.00	0.394	0.383	0.372	0.361	0.351	0.340
%12697183.00	0.414	0.402	0.391	0.379	0.368	0.357
%12698283.00	0.434	0.422	0.410	0.398	0.386	0.374
%12699383.00	0.456	0.443	0.430	0.417	0.405	0.392

Y [ft]	<- X [ft] ->					
	721909	723009	724109	725209	726309	727409
%12700483.00	0.478	0.464	0.451	0.437	0.424	0.411
%12701583.00	0.501	0.486	0.472	0.458	0.444	0.430
%12702683.00	0.525	0.510	0.495	0.480	0.465	0.450
%12703783.00	0.549	0.534	0.518	0.502	0.486	0.471
%12704883.00	0.575	0.558	0.542	0.525	0.509	0.492
%12705983.00	0.602	0.584	0.566	0.549	0.532	0.514
%12707083.00	0.629	0.611	0.592	0.574	0.555	0.537
%12708183.00	0.658	0.638	0.619	0.599	0.580	0.561
%12709283.00	0.687	0.667	0.646	0.626	0.605	0.585
%12710383.00	0.718	0.696	0.674	0.653	0.631	0.610
%12711483.00	0.749	0.726	0.703	0.681	0.658	0.636
%12712583.00	0.782	0.757	0.733	0.709	0.686	0.662
%12713683.00	0.815	0.790	0.764	0.739	0.714	0.690
%12714783.00	0.850	0.823	0.796	0.770	0.743	0.718
%12715883.00	0.885	0.857	0.829	0.801	0.773	0.746
%12716983.00	0.922	0.892	0.862	0.833	0.804	0.775
%12718083.00	0.959	0.928	0.897	0.866	0.835	0.805
%12719183.00	0.998	0.965	0.932	0.899	0.867	0.836
%12720283.00	1.037	1.003	0.968	0.934	0.900	0.867
%12721383.00	1.078	1.041	1.005	0.969	0.934	0.899
%12722483.00	1.120	1.081	1.043	1.005	0.968	0.931
%12723583.00	1.162	1.121	1.081	1.041	1.002	0.964
%12724683.00	1.206	1.163	1.120	1.078	1.037	0.997
%12725783.00	1.250	1.205	1.160	1.116	1.073	1.030
%12726883.00	1.295	1.248	1.201	1.154	1.109	1.064
%12727983.00	1.341	1.291	1.241	1.193	1.145	1.098
%12729083.00	1.388	1.335	1.283	1.232	1.181	1.132
%12730183.00	1.436	1.380	1.325	1.271	1.218	1.166
%12731283.00	1.484	1.425	1.366	1.310	1.254	1.200
%12732383.00	1.532	1.470	1.408	1.349	1.290	1.234
%12733483.00	1.581	1.515	1.450	1.387	1.326	1.267
%12734583.00	1.630	1.560	1.492	1.426	1.361	1.299
%12735683.00	1.678	1.604	1.533	1.463	1.396	1.331
%12736783.00	1.726	1.648	1.573	1.500	1.429	1.362
%12737883.00	1.774	1.691	1.612	1.535	1.461	1.391
%12738983.00	1.820	1.732	1.649	1.568	1.492	1.418
%12740083.00	1.864	1.772	1.684	1.600	1.520	1.444
%12741183.00	1.905	1.808	1.716	1.629	1.546	1.467
%12742283.00	1.943	1.842	1.746	1.655	1.569	1.487
%12743383.00	1.977	1.871	1.771	1.677	1.588	1.505

Y [ft]	721909	723009	724109	725209	726309	727409
%12744483.00	2.006	1.896	1.792	1.696	1.604	1.519
%12745583.00	2.029	1.915	1.809	1.709	1.616	1.529
%12746683.00	2.044	1.928	1.819	1.719	1.624	1.536
%12747783.00	2.052	1.934	1.824	1.722	1.627	1.538
%12748883.00	2.051	1.933	1.823	1.721	1.626	1.536
%12749983.00	2.042	1.924	1.815	1.714	1.619	1.531
%12751083.00	2.024	1.909	1.801	1.701	1.608	1.520
%12752183.00	1.998	1.886	1.781	1.683	1.592	1.506
%12753283.00	1.965	1.857	1.756	1.661	1.572	1.488
%12754383.00	1.926	1.822	1.725	1.634	1.548	1.466
%12755483.00	1.881	1.783	1.690	1.603	1.520	1.441
%12756583.00	1.832	1.739	1.652	1.568	1.489	1.413
%12757683.00	1.780	1.693	1.610	1.531	1.455	1.383
%12758783.00	1.725	1.644	1.566	1.491	1.419	1.350
%12759883.00	1.668	1.593	1.520	1.449	1.381	1.316
%12760983.00	1.611	1.541	1.473	1.406	1.342	1.280
%12762083.00	1.554	1.489	1.425	1.363	1.302	1.243
%12763183.00	1.497	1.436	1.376	1.318	1.261	1.206
%12764283.00	1.440	1.384	1.328	1.273	1.220	1.168
%12765383.00	1.384	1.332	1.280	1.229	1.179	1.130
%12766483.00	1.329	1.280	1.232	1.184	1.137	1.091
%12767583.00	1.275	1.230	1.185	1.140	1.096	1.053
%12768683.00	1.223	1.181	1.139	1.097	1.056	1.015
%12769783.00	1.172	1.133	1.094	1.055	1.016	0.978
%12770883.00	1.122	1.086	1.049	1.013	0.977	0.941
%12771983.00	1.074	1.040	1.006	0.972	0.938	0.904
%12773083.00	1.028	0.996	0.964	0.932	0.900	0.869
%12774183.00	0.983	0.953	0.923	0.894	0.864	0.834
%12775283.00	0.939	0.912	0.884	0.856	0.828	0.800

Y [ft]	728509	729609	730709	731809	732909	734009
%12686183.00	0.209	0.203	0.196	0.190	0.184	0.178
%12687283.00	0.220	0.214	0.207	0.200	0.194	0.187
%12688383.00	0.232	0.225	0.218	0.211	0.204	0.197
%12689483.00	0.244	0.237	0.229	0.222	0.215	0.207
%12690583.00	0.257	0.249	0.241	0.233	0.226	0.218
%12691683.00	0.271	0.262	0.254	0.245	0.237	0.229
%12692783.00	0.284	0.275	0.267	0.258	0.249	0.241
%12693883.00	0.299	0.289	0.280	0.271	0.262	0.253
%12694983.00	0.314	0.304	0.294	0.284	0.275	0.265
%12696083.00	0.329	0.319	0.308	0.298	0.288	0.278
%12697183.00	0.345	0.334	0.323	0.313	0.302	0.291

Y [ft]	<- X [ft] -> 728509	729609	730709	731809	732909	734009
%12698283.00	0.362	0.351	0.339	0.328	0.316	0.305
%12699383.00	0.380	0.367	0.355	0.343	0.331	0.320
%12700483.00	0.398	0.385	0.372	0.359	0.347	0.334
%12701583.00	0.416	0.403	0.389	0.376	0.363	0.350
%12702683.00	0.436	0.421	0.407	0.393	0.379	0.365
%12703783.00	0.455	0.440	0.425	0.411	0.396	0.382
%12704883.00	0.476	0.460	0.444	0.429	0.414	0.399
%12705983.00	0.497	0.481	0.464	0.448	0.432	0.416
%12707083.00	0.519	0.502	0.484	0.467	0.450	0.434
%12708183.00	0.542	0.523	0.505	0.487	0.469	0.452
%12709283.00	0.565	0.546	0.526	0.507	0.489	0.471
%12710383.00	0.589	0.569	0.548	0.529	0.509	0.490
%12711483.00	0.614	0.592	0.571	0.550	0.529	0.509
%12712583.00	0.639	0.617	0.594	0.572	0.551	0.529
%12713683.00	0.665	0.641	0.618	0.595	0.572	0.550
%12714783.00	0.692	0.667	0.642	0.618	0.594	0.571
%12715883.00	0.719	0.693	0.667	0.642	0.617	0.592
%12716983.00	0.747	0.720	0.692	0.666	0.640	0.614
%12718083.00	0.776	0.747	0.718	0.690	0.663	0.636
%12719183.00	0.805	0.774	0.744	0.715	0.686	0.658
%12720283.00	0.834	0.802	0.771	0.740	0.710	0.681
%12721383.00	0.864	0.831	0.798	0.766	0.734	0.704
%12722483.00	0.895	0.860	0.825	0.792	0.759	0.727
%12723583.00	0.926	0.889	0.853	0.818	0.783	0.750
%12724683.00	0.957	0.919	0.881	0.844	0.808	0.773
%12725783.00	0.989	0.948	0.909	0.870	0.833	0.796
%12726883.00	1.021	0.978	0.937	0.897	0.857	0.820
%12727983.00	1.052	1.008	0.965	0.923	0.882	0.843
%12729083.00	1.084	1.038	0.993	0.949	0.906	0.865
%12730183.00	1.116	1.068	1.020	0.975	0.931	0.888
%12731283.00	1.148	1.097	1.048	1.000	0.954	0.910
%12732383.00	1.179	1.126	1.075	1.025	0.977	0.931
%12733483.00	1.210	1.154	1.101	1.049	1.000	0.952
%12734583.00	1.240	1.182	1.126	1.073	1.022	0.972
%12735683.00	1.269	1.209	1.151	1.096	1.043	0.992
%12736783.00	1.297	1.234	1.174	1.117	1.062	1.010
%12737883.00	1.323	1.258	1.196	1.137	1.081	1.027
%12738983.00	1.348	1.281	1.217	1.156	1.098	1.043
%12740083.00	1.371	1.302	1.236	1.173	1.114	1.057
%12741183.00	1.392	1.321	1.253	1.189	1.128	1.070

Y [ft]	<- X [ft] ->					
	728509	729609	730709	731809	732909	734009
%12742283.00	1.410	1.337	1.268	1.202	1.140	1.080
%12743383.00	1.425	1.351	1.280	1.213	1.150	1.090
%12744483.00	1.438	1.362	1.290	1.222	1.157	1.097
%12745583.00	1.447	1.370	1.297	1.228	1.163	1.102
%12746683.00	1.453	1.375	1.301	1.232	1.166	1.105
%12747783.00	1.455	1.376	1.303	1.233	1.167	1.105
%12748883.00	1.453	1.375	1.301	1.231	1.166	1.104
%12749983.00	1.448	1.370	1.296	1.227	1.162	1.100
%12751083.00	1.438	1.361	1.288	1.220	1.155	1.094
%12752183.00	1.425	1.349	1.278	1.210	1.146	1.086
%12753283.00	1.409	1.335	1.264	1.198	1.135	1.076
%12754383.00	1.389	1.317	1.248	1.184	1.122	1.064
%12755483.00	1.367	1.297	1.230	1.167	1.107	1.050
%12756583.00	1.342	1.274	1.209	1.148	1.089	1.034
%12757683.00	1.314	1.249	1.186	1.127	1.070	1.016
%12758783.00	1.285	1.222	1.162	1.104	1.050	0.998
%12759883.00	1.253	1.193	1.136	1.081	1.028	0.977
%12760983.00	1.221	1.163	1.108	1.055	1.005	0.956
%12762083.00	1.187	1.132	1.080	1.029	0.980	0.934
%12763183.00	1.152	1.100	1.050	1.002	0.955	0.911
%12764283.00	1.117	1.068	1.020	0.974	0.930	0.887
%12765383.00	1.082	1.035	0.990	0.946	0.904	0.863
%12766483.00	1.046	1.002	0.959	0.917	0.877	0.838
%12767583.00	1.010	0.969	0.928	0.889	0.850	0.813
%12768683.00	0.975	0.936	0.897	0.860	0.823	0.788
%12769783.00	0.940	0.903	0.866	0.831	0.796	0.762
%12770883.00	0.905	0.870	0.836	0.802	0.769	0.737
%12771983.00	0.871	0.838	0.806	0.774	0.742	0.712
%12773083.00	0.837	0.806	0.776	0.746	0.716	0.687
%12774183.00	0.804	0.775	0.746	0.718	0.690	0.662
%12775283.00	0.772	0.745	0.717	0.691	0.664	0.638

Y [ft]	<- X [ft] ->		
	735109	736209	737309
%12686183.00	0.172	0.166	0.160
%12687283.00	0.181	0.175	0.168
%12688383.00	0.190	0.184	0.177
%12689483.00	0.200	0.193	0.186
%12690583.00	0.211	0.203	0.196
%12691683.00	0.221	0.213	0.206
%12692783.00	0.232	0.224	0.216
%12693883.00	0.244	0.235	0.227
%12694983.00	0.256	0.247	0.238

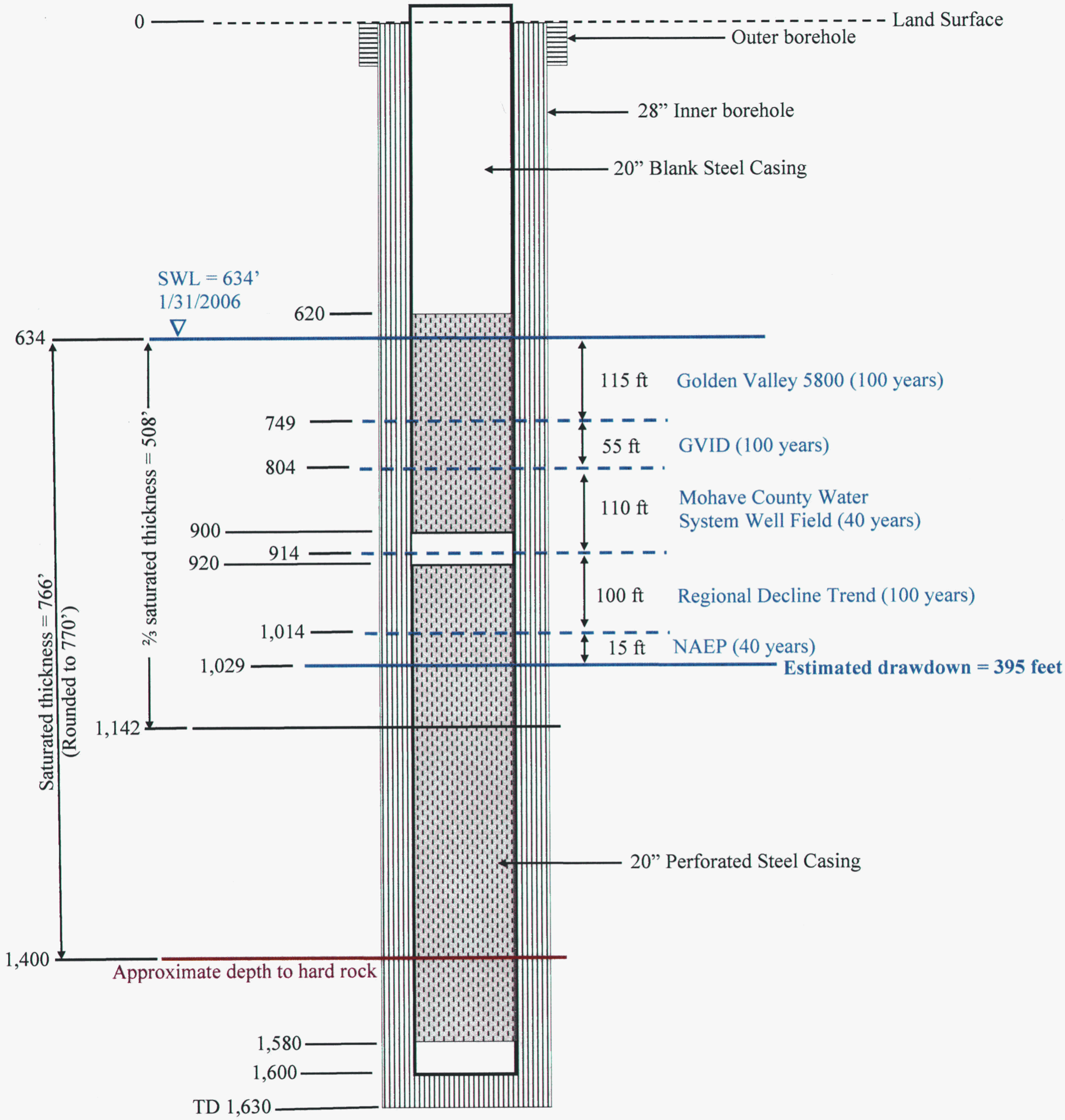
Y [ft]	<- X [ft] ->		
	735109	736209	737309
%12696083.00	0.268	0.259	0.249
%12697183.00	0.281	0.271	0.261
%12698283.00	0.294	0.284	0.273
%12699383.00	0.308	0.297	0.286
%12700483.00	0.322	0.310	0.299
%12701583.00	0.337	0.324	0.312
%12702683.00	0.352	0.339	0.326
%12703783.00	0.368	0.354	0.340
%12704883.00	0.384	0.369	0.355
%12705983.00	0.400	0.385	0.370
%12707083.00	0.417	0.401	0.386
%12708183.00	0.435	0.418	0.402
%12709283.00	0.453	0.435	0.418
%12710383.00	0.471	0.452	0.434
%12711483.00	0.490	0.470	0.451
%12712583.00	0.509	0.489	0.469
%12713683.00	0.528	0.507	0.486
%12714783.00	0.548	0.526	0.504
%12715883.00	0.568	0.545	0.523
%12716983.00	0.589	0.565	0.541
%12718083.00	0.610	0.585	0.560
%12719183.00	0.631	0.605	0.579
%12720283.00	0.653	0.625	0.598
%12721383.00	0.674	0.645	0.617
%12722483.00	0.696	0.666	0.636
%12723583.00	0.718	0.686	0.656
%12724683.00	0.739	0.707	0.675
%12725783.00	0.761	0.727	0.694
%12726883.00	0.783	0.748	0.713
%12727983.00	0.805	0.768	0.732
%12729083.00	0.826	0.788	0.751
%12730183.00	0.847	0.807	0.769
%12731283.00	0.867	0.826	0.787
%12732383.00	0.887	0.845	0.804
%12733483.00	0.907	0.863	0.821
%12734583.00	0.925	0.880	0.837
%12735683.00	0.943	0.896	0.852
%12736783.00	0.960	0.912	0.866
%12737883.00	0.975	0.926	0.879
%12738983.00	0.990	0.939	0.892

Y [ft]	<- X [ft] ->		
	735109	736209	737309
%12740083.00	1.003	0.951	0.902
%12741183.00	1.014	0.962	0.912
%12742283.00	1.024	0.971	0.920
%12743383.00	1.033	0.978	0.927
%12744483.00	1.039	0.984	0.933
%12745583.00	1.043	0.988	0.936
%12746683.00	1.046	0.991	0.938
%12747783.00	1.047	0.991	0.939
%12748883.00	1.045	0.990	0.937
%12749983.00	1.042	0.987	0.934
%12751083.00	1.036	0.982	0.930
%12752183.00	1.029	0.975	0.924
%12753283.00	1.020	0.966	0.916
%12754383.00	1.008	0.956	0.906
%12755483.00	0.996	0.944	0.895
%12756583.00	0.981	0.931	0.883
%12757683.00	0.965	0.916	0.870
%12758783.00	0.948	0.900	0.855
%12759883.00	0.929	0.883	0.839
%12760983.00	0.910	0.865	0.822
%12762083.00	0.889	0.846	0.805
%12763183.00	0.868	0.826	0.786
%12764283.00	0.846	0.806	0.767
%12765383.00	0.823	0.785	0.748
%12766483.00	0.800	0.763	0.728
%12767583.00	0.777	0.742	0.708
%12768683.00	0.753	0.720	0.687
%12769783.00	0.729	0.698	0.667
%12770883.00	0.706	0.675	0.646
%12771983.00	0.682	0.653	0.625
%12773083.00	0.659	0.631	0.604
%12774183.00	0.636	0.609	0.584
%12775283.00	0.613	0.588	0.564

Attachment VII

ATTACHMENT VII

Figure 3 – Estimated Drawdown at Production Well #8, 55-580149
B(19-18) 10aaa



-Drawing Not to Scale
-Casing Centralizers Every 80 feet

Southwest Ground-water Consultants, Inc. June 21, 2007 Project B.1476	ESTIMATED DRAWDOWN AT PRODUCTION WELL 8 55-580149 B(19-18)10 aaa Mohave County Water System Well Field, Arizona	Figure 3